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THE MEAT INDUSTRY
AND
MEAT INSPECTION

THE MEAT INDUSTRY
AND
MEAT INSPECTION

A COMPREHENSIVE ACCOUNT OF THE PRINCIPAL
ANIMALS AND FISH, INCLUDING CATTLE, SHEEP,
PIGS, POULTRY AND GAME, SUPPLIED TO THE
BRITISH MEAT MARKET, TOGETHER WITH
A DESCRIPTION OF THE VARIOUS INDUSTRIAL PROCESSES CONNECTED
THEREWITH AND THE SCIENTIFIC
INSPECTION OF MEAT

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DOUGLAS'S ENCYCLOPÆDIA FOR THE MEAT, BACON,
AND FOOD TRADES

THIRTY-FIVE COLOURED PLATES
ONE THOUSAND ILLUSTRATIONS

VOLUME I

THE EDUCATIONAL BOOK COMPANY, LTD.
210 TEMPLE CHAMBERS, LONDON, E.C.

7529

TO

ALEXANDER INGLIS McCALLUM
J.P., M.R.C.V.S.,

WHO FOUNDED THE CHAIR OF

PATHOLOGY, BACTERIOLOGY AND
MEAT INSPECTION

IN THE

ROYAL (DICK) VETERINARY COLLEGE,
EDINBURGH

PREFACE

In these volumes an effort has been made to supply a complete treatise on the various departments of the Meat Industry of the United Kingdom, and so redeem promises made by my colleague and myself to students and to others interested in the many departments of the great Meat Industry of this country. The time and labour necessary to carry out these promises have been made possible of attainment primarily by the establishment of the Chair of Pathology and Bacteriology (including Meat Inspection) in the Royal (Dick) Veterinary College, Edinburgh; and this is due to the munificence of Mr. A. I. M'Callum, J.P., M.R.C.V.S. To him, therefore, in recognition of the great service thus rendered to the cause of veterinary science, this work is inscribed.

It must be remembered that, while the meat inspector controls the principal part of our food-supply, there is also a large and ever-growing number of those who, by reason of their being brought into daily contact with one or other section of the meat industry, are eager to learn that part of its technique which affects themselves. The meat-purveyor is a notable example of this desire. He stands midway between the farmer, or producer, and the consumer, and the latter relies upon him to be sufficiently familiar with his business to prevent the distribution of meat of a dangerous character. The consumer demands the same security from other food-purveyors, such as fishmongers, poulterers, and game dealers, and it is therefore to the interests of the members of these different branches of the Food Industries that they should have some guide in matters pertaining to the proper handling of the food products which constitute their business. This guidance, it is hoped, will be found in these volumes, since, at the present time, it cannot all be acquired in any educational institution, for the simple reason that a thorough knowledge of the Meat Industry in all its branches has not been systematised for teaching purposes. It may be hoped that the time is coming when such systematised knowledge and teaching will be made available in educational institutions.

In addition to the classes or persons mentioned, there are many others to whom, it is believed, these pages will appeal. There are, for example, those who are engaged in the organisation of the Meat Industry, abattoir officers, meat importers, bacon-curers, sausage-makers, cold-storage proprietors, and many others whose part in this great business will readily suggest itself to those who take any interest in the subject.

It will be at once obvious that in order to provide the information required, it has been necessary to seek the aid and advice of a great many of the best minds engaged in the production, handling, and supervision of the meat supplies of the country. This has been done, and the matter contained in these volumes, as well as its arrangement, has been determined upon as far as possible in accordance with the wishes and advice so given. This has involved an immense correspondence and many personal visits, but it is impossible to exaggerate the thanks due to so many Medical Officers of Health, Pathologists, Bacteriologists, Meat Inspectors, Meat-purveyors, Manufacturers, and Importers for assistance rendered.

It was, of course, essential that certain sections, if they were to be authoritative, should be placed in the hands of experts in those particular branches. In this respect I was most fortunate in being able to obtain the services of Mr. Loudon M. Douglas, well known as an expert in the Meat Industry, as my colleague and collaborator in the whole work. He is responsible for the whole of the contents of Vol. II., as well as for the section on Swine Husbandry in Vol. I.; and has, in addition, given much help in connection with the entire work.

Certain subsidiary sections have also been written specially for this work, of which the following must be mentioned: Mr. F. G. Aflalo has written the descriptions of the various species of edible fish; Mr. Joseph Dobbie, S.S.C., is responsible for the legal section; Mr. T. Parker, F.R.C.V.S. has contributed the chapter on Warranty, Compensation, and Insurance; and the section on Poultry is by Miss May McQuillan.

In collecting together all the material and illustrations it has been necessary, as our pages show, to call to our aid almost every civilised country. Numerous centres of the Meat Industry, both at home and abroad, have been visited by the authors, and the correspondence has extended from Great Britain to America, to Australasia, and all over Europe to Hungary. In this way an immense number of willing helpers have been associated with the production of this work, from all of whom the greatest courtesy has been received.

It is especially pleasing to have to acknowledge indebtedness to many fellow workers on the Continent of Europe, in America, and in the various Colonies of the Empire, as well as to many in the United Kingdom. It is impossible to mention every name, but the following have given such valuable aid that special mention must be made of them. Amongst those on the Continent thanks are specially due to: Professor W. Ellenberger and Professor H. Baum, of Dresden, for kind permission to reproduce Figs. 2, 3, 5, 6, 7, 9, 15, 16, 17, 27, 29, and 30 in chap. xi., and Figs. 1, 2, and 3 in chap. xii. Vol. III., from their well-known "Anatomie der Haustiere" (published by August Hirschwald, Berlin); Martin Sandeborg, Director of the Gothenburg abattoir, and his staff of Inspectors; Professors Jensen and Mörkeborg, of Copenhagen; Dr. Mälm, of Christiania; and the Directors and Inspectors of the abattoirs of many cities both at home and abroad.

In America, thanks are due to Dr. Melvin, chief of the Bureau of Animal

Industry, Washington, for permission to use illustrations and material issued by his Department.

The Governments of New Zealand and Australia have placed many facilities at our disposal, through the Agents-General of the Commonwealth of Australia and the High Commissioner of New Zealand.

In our own country much assistance has been given by many Medical Officers of Health, without whose co-operation the accounts of Meat Inspection in British cities (Vol. IV.) could not have been written. Thanks are due to all those whose names appear in the text.

Professor Sheridan Delépine, of Manchester, has most generously placed at my disposal the whole of his splendid collection of photographs ;[*] Dr. W. E. Hope, M.O.H., of Liverpool, has supplied others ; as have also Professor R. C. F. Leith, of Birmingham, Dr. Robertson, M.O.H., of Birmingham, Dr. Wilson, M.O.H., Hamilton, and Dr. Trimble of Belfast. To all of these the most cordial thanks are offered.

Much of the work described has been carried out at the Edinburgh abattoir, and many of the photographs reproduced are of specimens encountered there. In this connection my very best thanks are due to Dr. Williamson, M.O.H., Edinburgh, and his staff at the abattoir, all of whom have rendered valuable aid, and have supplied many of the specimens illustrated.

A special word of appreciation is due to the artists who are responsible for the coloured plates. Those of animal carcases and organs are by Miss Kelman, and are from specimens seized at the Edinburgh abattoir or supplied by Principal Dewar. The bacon, ham, and sausage plates are by Miss Minnie Douglas. Permission for the reproduction of two coloured plates of Swine Fever (Plates VII. and VIII.) was kindly accorded by Dr. Poels, of Rotterdam, and for that of Swine Tuberculosis by Dr. Melvin, of Washington, U.S.A.

A large number of the photographic illustrations are now reproduced for the first time, either from the authors' photographs, or from the varied sources already mentioned. In addition, some have been kindly lent by The Macmillan Company from their "Cyclopædia of American Agriculture," while those of bacteriological apparatus are reproduced by kind permission of Messrs. Watson and Sons (through Mr. Pierce, Edinburgh). Other special illustrations are acknowledged in the text.

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[*] Professor Delépine states that the material from which he prepared the specimens represented in the photographs (to which his name is attached in the text) has been sent to him during the past fourteen years by the following gentlemen: R. S. Marsden, M.B., D.P.H., M.O.H., Birkenhead ; W. F. Dearden, L.R.C.P., M.R.C.S., D.P.H., M.O.H., Manchester Port ; A. B. Brindley, M.D., D.P.H., M.O.H., Derby ; A. Greenwood, M.D., D.P.H., Blackburn ; W. Woods, F.R.C.V.S., Lecturer in Veterinary Hygiene, Manchester ; J. S. Wolstenholme, F.R.C.V.S., Salford ; J. S. Lloyd, F.R.C.V.S., D.V.S.M., Sheffield ; J. D. Whitehead, F.R.C.V.S. ; D.V.S.M., Salford ; J. W. Brittlebank, M.R.C.V.S., D.V.S.M., Manchester ; J. M. Stirling (Late) M.R.C.V.S., Blackburn ; A. Holburn, M.R.C.V.S., Congleton ; A. D. Minor, M.R.C.V.S., Manchester ; J. King (Late) M.R.C.V.S., London.

In connection with the contents of Vol. II. and the other sections written by him, Mr. Loudon M. Douglas writes :

" Our acknowledgments are due to many kind friends who have assisted in various ways, and amongst these should be mentioned Mr. Alderman John Lindsay, of Putney, President of the Meat Traders' Federation of the United Kingdom ; and Mr. T. G. Fisher, Moderator of the High Constables of Edinburgh, and Ex-President of the Edinburgh Master Butchers' Association ; both of whom have lent considerable assistance in the designing of the typical carcases of various animals, and in other ways.

" Mr. James Williamson, Junr., J.P., Boxmaster of the Aberdeen Fleshers' Corporation, has also assisted with some interesting local references and illustrations.

" We are indebted to Mr. J. F. Reid, Editor of the *Meat Trades Journal*, for valuable aid and permission to use some of the matter which has appeared in the columns of that paper.

" Mr. C. Cash, B.A., of Coventry, whose interest in abattoirs is well known, has provided most of the illustrations of primitive abattoirs which illustrate that part of the subject.

" Amongst the firms of manufacturers who have helped us with illustrations, and to whom we are grateful, are the following :

" Messrs. The Brecht B. S. Co., St. Louis, U.S.A., and the Cincinnati Butchers' Supply Co., Cincinnati, U.S.A., for illustrations of American packers' appliances.

" Messrs. John Gardner and Son, of Birmingham ; Messrs. William Douglas and Sons, Ltd., of Putney ; Messrs. Von der Nahmer, of Remscheid, and Gebruder Wyler, of Basle, for illustrations of sausage-making and other appliances.

" Refrigerating machine makers who have kindly lent us illustrations are :

" Messrs. L. Sterne and Co., Ltd., Glasgow ; Messrs. J. and E. Hall, Ltd., Dartford ; Messrs. William Douglas and Sons, Ltd., Putney ; Messrs. Haslam, Derby ; Messrs. The Liverpool Refrigeration Co., Ltd., Liverpool ; Messrs. Ransomes and Rapier, Ltd., Victoria Street, London, and other makers of refrigerating plant. We are also grateful to the Editor of *Ice and Cold Storage* for the use of illustrations and other matter which have appeared in that journal.

" We are indebted to Mr. John Clay, of Chicago, for obtaining some of the illustrations referring to United States Live Stock.

" Dr. Remmells, of The Hague, Holland, deserves our special thanks for the illustrations of the Dutch Meat Industry in its various branches. Mr. John Brown, of Cartyne Chemical Works, Glasgow, has kindly furnished the photographs of the blood-drying factory which we are thus enabled to give.

" The illustrations of shops are derived from several sources, and we are indebted for these, amongst others, to :

" Messrs. Carters, of Poole, Dorset ; Messrs. Steinberg and Vorsanger, Wiesbaden; Messrs. Berth Levi and Co., New York., U.S.A.; Messrs. Annacker, Ltd., of Glasgow; Messrs. Brechin Bros., Ltd., of Edinburgh; and Mr. Fred. Elliott, of Barnstaple.

"The Colonial illustrations which we are able to give are largely illustrative of the splendid factories of the Christchurch Meat Company, Ltd., Smithfield, London; and The Australian Meat Co., Ltd., Great Tower Street, London; to both of whom we are indebted for putting these at our disposal.

"In constructing a voluminous work of this sort, and building it up from the beginning, it will be understood that we have been indebted to many friends for assistance as the work has progressed, and it would be impossible to enumerate them all, or to give an account of their valuable services. At the same time we would like to say that we are grateful for such assistance as has been given to us, and if the names of our many helpers are not given here, it is not because we think lightly of their assistance, but simply that the list, to make it at all complete, would be very long."

With regard to the authorities whose works have been consulted on various matters, and whose opinions have been asked, special reference must be made to Professor Ostertag's "Handbook of Meat Inspection"; Professor Wallace's "Farm Live-stock of Great Britain"; "Encyclopædia of Agriculture" (Wm. Green and Sons); to the Report by Dr. Dittmar on Meat Inspection and Abattoirs in Scotland; to Muir and Ritchie's "Manual of Bacteriology"; and to "Douglas's Encyclopædia."

In addition to all those whose names we have mentioned, there are many others who have placed material and illustrations at our disposal, some of which it has been found impossible to include. Our thanks are none the less due to them for their kind interest. Many names also will be found mentioned in the text in connection with assistance rendered.

It is not unlikely that errors may have crept into this work and we shall be glad if any such are pointed out to us, and would also welcome any criticism or advice which may be of use in improving any future editions.

GERALD LEIGHTON, M.D.

EDINBURGH, 1910.

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14. Diaphragm.
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16. Right ventricle.
17. Aorta.
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19. Auricle.
20. Interior of left ventricle.
21. Interior of left auricle.
22. Opening of aorta.
23. Interior of right ventricle.
24. Chordæ.
25. Interior of right auricle.
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28. Teeth.
29. Teeth.
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53. ,,
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6. Masseter.
7. Orbital.
8. Buccinator.
9. Masseter.
10. Ear-gland muscle.
11. Ear muscles.
12. ,,
13. ,,
14. Papillary muscle.
15. ,, ,,
16. Parotid gland.
17. Shoulder muscle.
18. Dorsal muscle.
19. Shoulder rotating muscle.
20. Extensor of forearm.
21. ,, ,,
22. Extensor of foot.
23. Serratus magnus.
24. Great pectoral.
25. Oblique abdominal.
26. Straight abdominal.
27. Tendinous muscle.
28. Greater croup muscle.
29. Outer croup muscle.
30. Extensor of thigh.
31. Abductor muscles.
32. Portion of abductor.
33. Posterior part of abductor.
34. Extensors of foot.
35. ,, ,,
36. ,, ,,
37. ,, ,,
38. ,, ,,
39. Ligament.
40. Tendons.
41. Hock-bone muscle.
42. Greater hock-bone muscle.
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7. Cervical vertebræ artery.
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9. Pectoral artery.
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37. Lower part of femoral.
38. Deep artery of penis.
39. Anterior arteries to skin.
40. Posterior arteries to skin.
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42. Hock-joint artery.
43. Metatarsal artery.
44. Artery to hoof and toe.
45. Anterior vena cava.
46. Jugular vein.
47. Posterior vena cava.
48. Portal veins.
49. ,, ,,
50. ,, ,,
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1. Upper jaw.
2. Lower jaw.
3. Parietal bone.
4. Occipital.
5. Temporal.
6. Frontal.
7. Zygomatic.
8. Lacrymal.
9. Nasal.
10. Snout.
11. Superior maxillary.
12. Anterior maxillary.
13. Incisors.
14. Tip of lower jaw.
15. Tusk.
16. Molar teeth.
17. Orbit.
18. Cervical vertebræ.
19. ,, ,,
20. Dorsal vertebræ, 14.
21. Lumbar vertebræ, 7.
22. Sacrum.
23. Coccygeal vertebræ.
24. Ribs.
25. Cartilage of ribs.
26. Ilium.
27. Pubic bone.
28. Ischium.
29. Hip-joint.
30. Shoulder-blade ("Blade bone").
31. ,, ,, ,,
32. Humerus.
33. Radius.
34. Ulna.
35. Elbow.
36. Wrist, carpus.
37. Metacarpal bones.
38. Phalanges.
39. ,,
40. Hoof.
41. Digit.
42. Femur.
43. Lower end of femur.
44. Tibia.
45. Fibula.
46. Ankle bones.
47. Os calcis.
48. Ankle bones, tarsal.
49. Metatarsal.
50. Phalanges.
51. ,,
52. Hoof.
53. Toe.

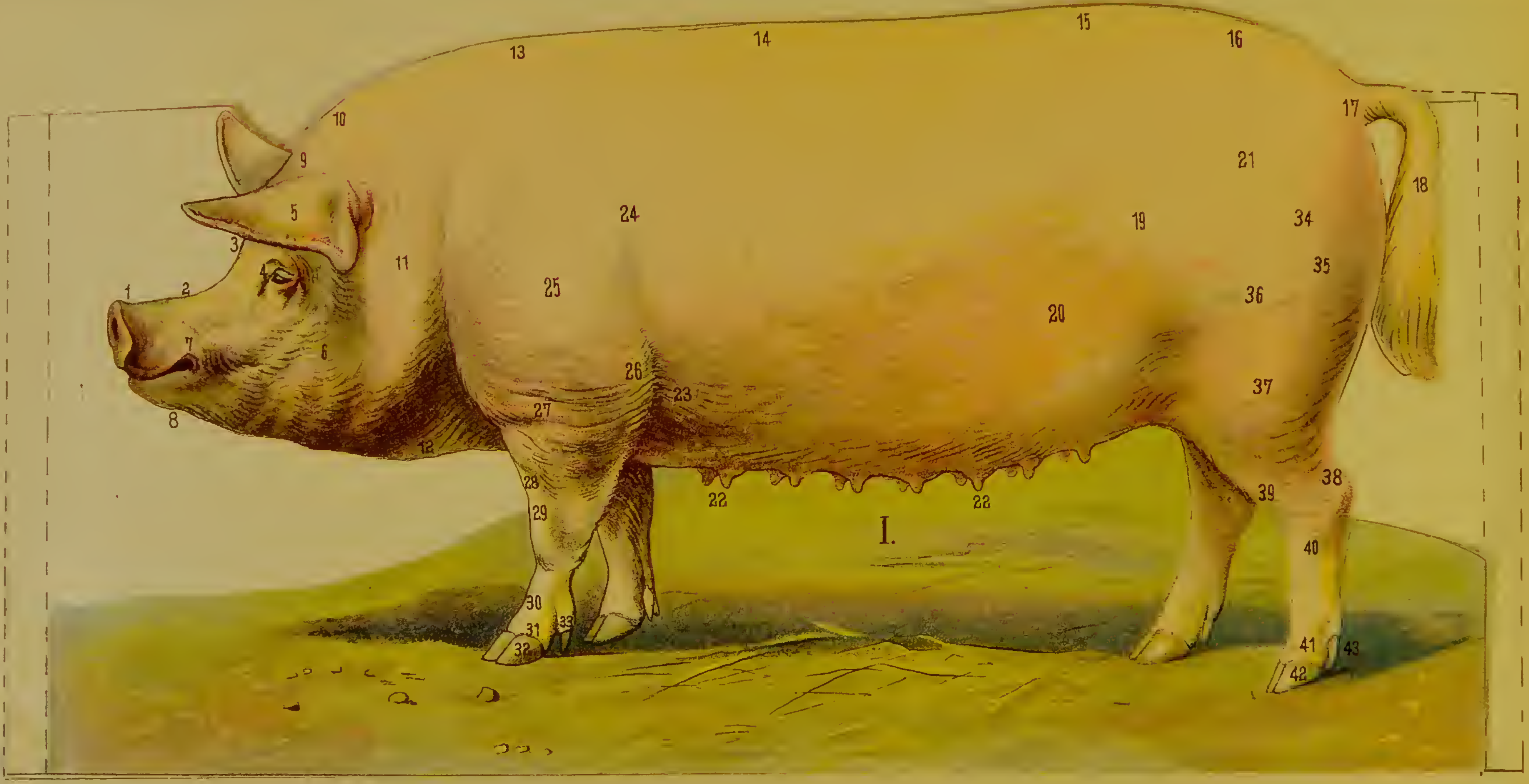
EXPLANATION OF MODEL OF PIG

The model of the pig is intended to explain the structure of the animal, that is, the anatomy of any and every kind of pig. The special anatomy of the bacon pig is dealt with in the volume itself.

SHEET I. EXTERNAL PARTS OF THE BODY

Descriptive term.	*Term used in bacon-curing.*	*Descriptive term.*	*Term used in bacon-curing.*
1. Snout.	Eye-piece.	23. Breast.	
2. Ridge of snout.		24. Shoulder.	
3. Forehead.		25. Shoulder-joint.	
4. Eye and eyelid.		26. Elbow-joint.	
5. Ear.		27. Forearm.	Hough.
6. Cheek.		28.	
7. Upper lip.		29.	
8. Chin.	Bath chap.	30. Fetlock.	Pig's feet.
9. Nape, neck.		31. ,,	
10. ,, ,,		32. Hoof.	
11. Neck.		33. Digit.	
12. Throat.		34. Thigh.	
13. Withers.	Shoulder.	35. ,,	
14. Back.	Loin.	36. ,,	
15. Loins.		37. Shin.	Ham.
16. Hind-quarter.*		38. Ankle, tarsal.	
17. Root of tail.		39. ,, ,,	
18. Tail.		40. Metatarsal.	Pig's feet.
19. Flank or groin.		41. ,,	
20. Belly.		42. Hoof.	
21. Hip.		43. Digit.	
22. Teats.			

* The hind-quarter comprises the hind leg from which hams are produced ; in a Wiltshire side the hind-quarter forms the gammon end.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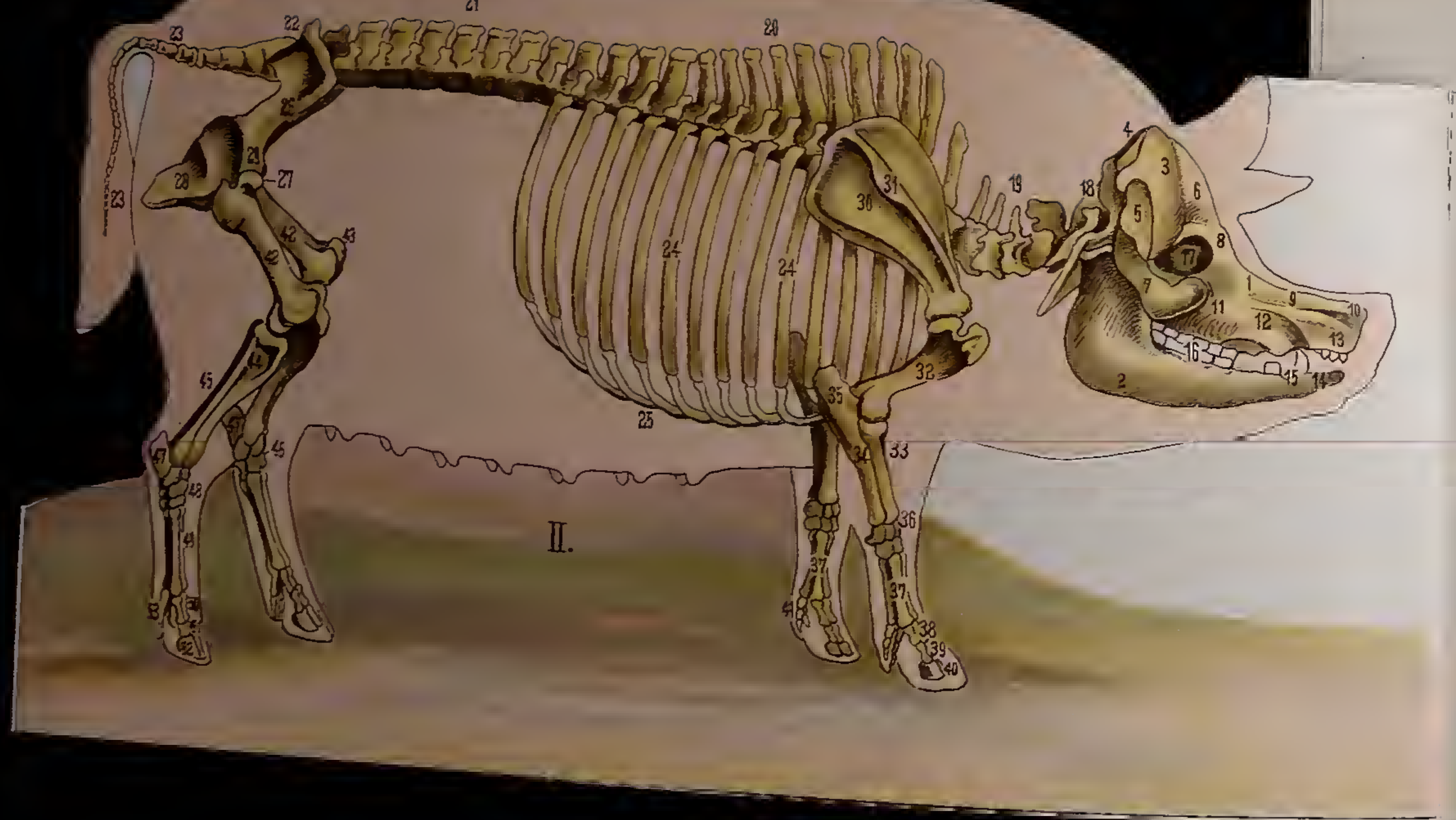
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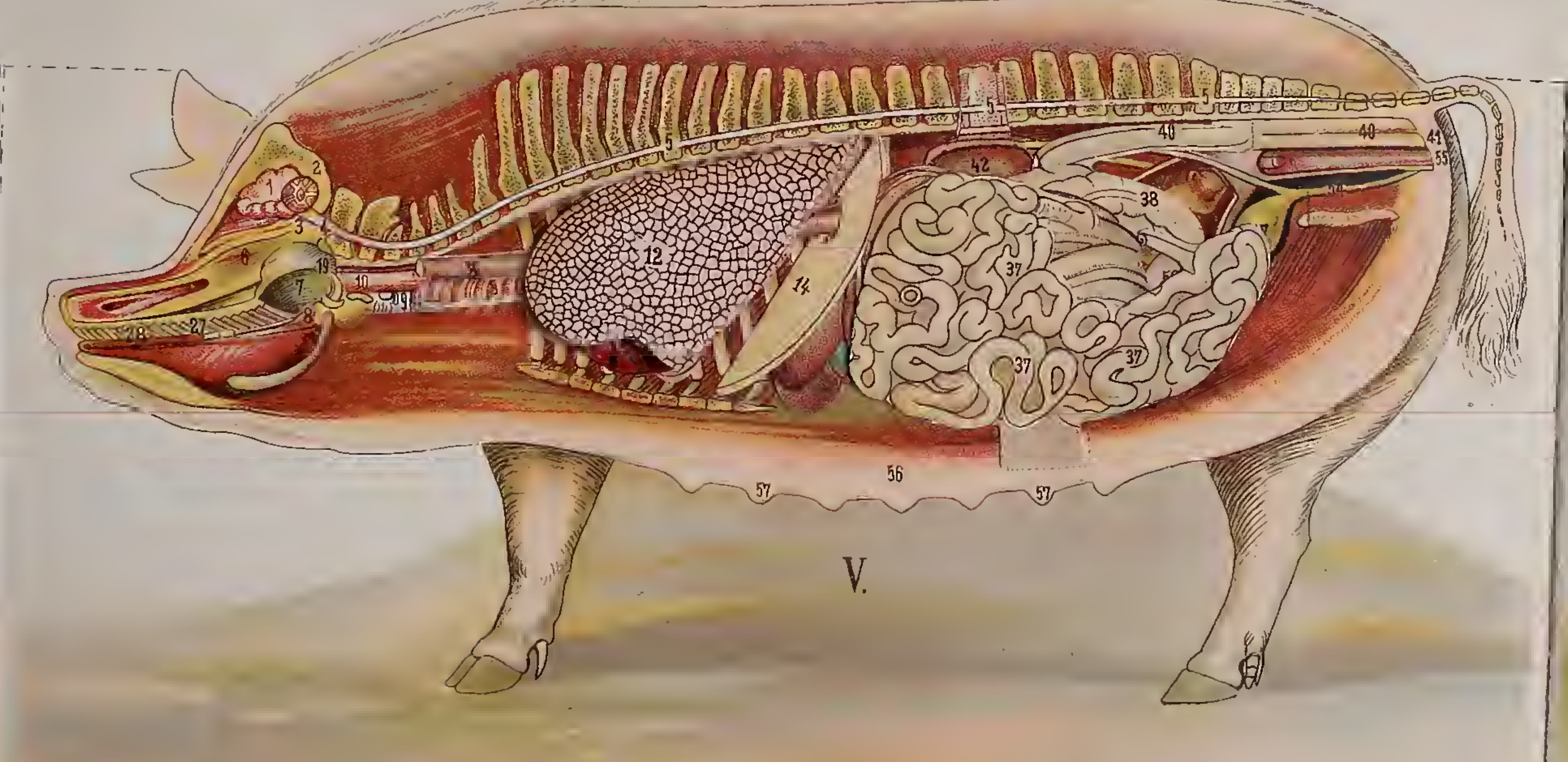
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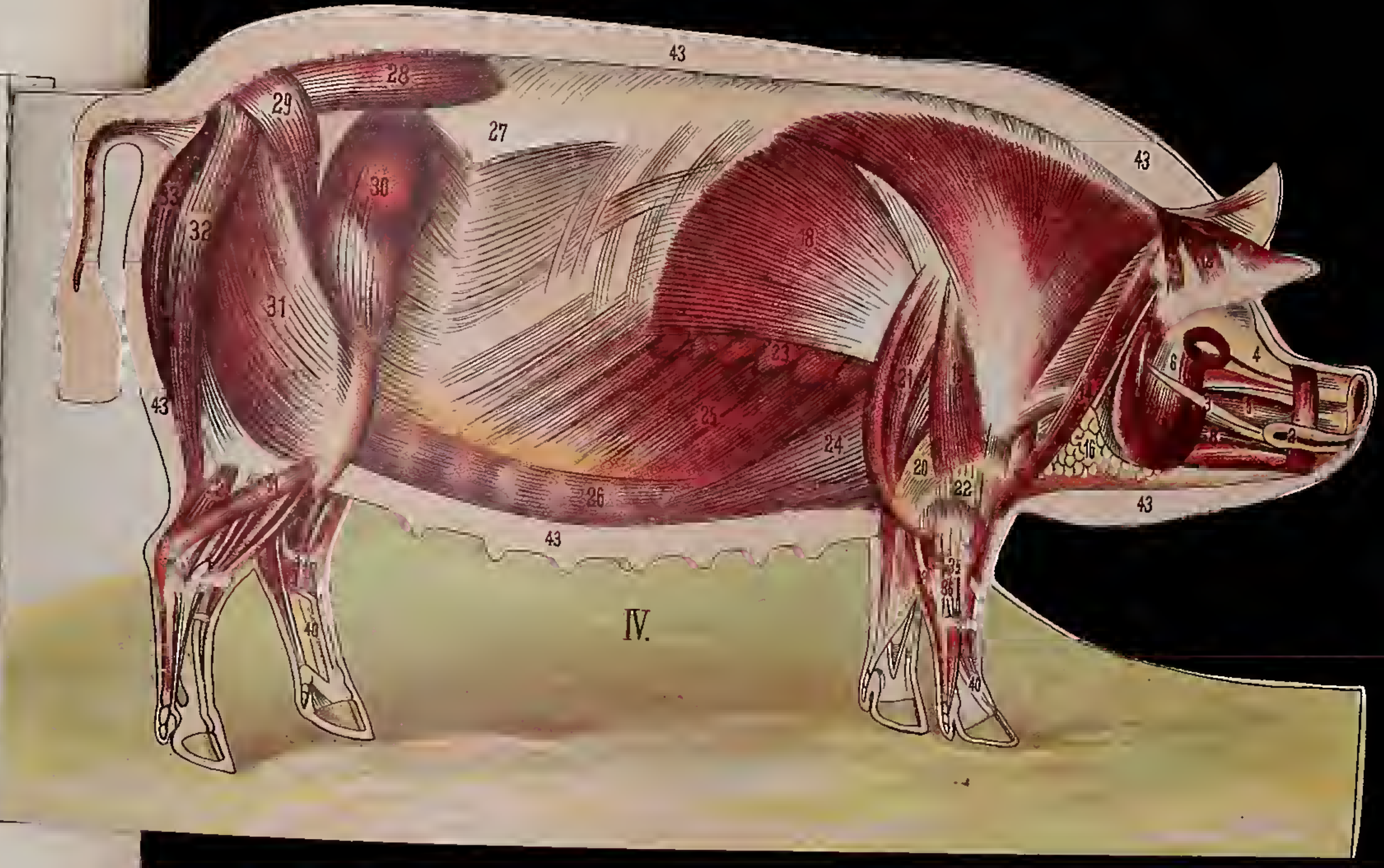
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IV.

CHAPTER I

INTRODUCTORY

THERE are probably very few people in Great Britain who have any accurate idea of the immense amount of capital and labour invested in and associated with the various departments of the meat industry, in spite of the fact that, with the exception of a small minority of dietetic faddists, every one is more or less dependent upon this industry for their daily food. As far as capital is concerned, there is possibly more money invested in the meat industry than in any other British business, except the business of money itself; and as regards the labour, it is extremely difficult to draw any hard-and-fast lines, or to say who is or who is not connected with it. When one thinks for a moment that the labourers include such varying classes as the breeder, the farmer, the salesman, the auctioneer, the slaughterer, the inspector, the medical officer of health, the meat-purveyor or butcher, the cook and, finally, the consumer, it becomes obvious that there can be but very few people who have no interest in the subject at all The list might be indefinitely extended, and perhaps particularly to include all those whose business it is to interest themselves in the public health, since this is one of the aspects of the meat industry which is at last beginning to force itself upon the attention of our municipal and other authorities.

The Literature of the Trade. It is, of course, quite beyond the scope of any one book to deal with all the various aspects above suggested in anything like full detail; but there are quite a number of these aspects which are very intimately connected with each other and which may conveniently be dealt with in a more or less continuous manner, and it is somewhat remarkable that in our own country, at least, there has not been a more serious effort to supply the literature of this subject than is the case. In this respect we are far behind most of our Continental neighbours, upon whom we have had to depend almost entirely for text-books and for sources of information in many of these matters. This is particularly true in connection with the literature of meat inspection, and those portions of the industry which deal with the various methods of supplying meat to the markets of the world, in which matters we have lagged far behind Germany, America, Holland, Denmark and other countries in the supply of books and pamphlets. In other branches of the subject, such as the breeding of animals and the various aspects of the meat industry which are more strictly agricultural, we have many excellent works by many eminent authorities; so that in the endeavour to supply a work which would give most of the information required it is not difficult to decide upon which parts of the subject should be dealt with fully, and which portions may be more briefly touched upon.

The object of the following pages, therefore, may be stated to be to supply to all those whose business or interests demand a knowledge of the subject such information as does not appear to be contained in any one British text-book. And since the two great divisions of the subject which seem to call at the present day for most detailed consideration are, first, all the various methods of handling the meat-supply which exist in this country, and, secondly, the various problems which are usually grouped together under the name of meat inspection, these two branches of the subject will occupy most of our attention. In order, however, that the whole question may be dealt with as far as possible in the form of a continuous and connected narrative, we shall deal briefly with those parts of the subject which have been fully described elsewhere, giving our readers such references as will enable them to obtain for themselves any further information they may require.

What this Book deals with. The principal events, so to speak, in such a narrative are, first, the different kinds of animals which constitute the *material* of the industry, their characteristics and distribution, and the general principles of dealing with them in order to render them fit for the salesman. Secondly, we have the events of the industry proper, namely, the bringing of the animals to the markets or places of disposal, and their subsequent slaughter and dressing. Thirdly, we have the important matter of their scientific inspection to determine whether or not the carcases are healthy and sound, or in such condition as to render them unfit for human consumption. These are, broadly speaking, the great events in such a narrative, and they include an enormous number of diverse processes, such as are connected with the great branch of frozen and chilled meat-importing, the curing of bacon and hams, the advantages and disadvantages of various methods adopted for killing animals, the structural and other arrangements of slaughter-houses and other buildings, the various methods adopted for the destruction of diseased carcases, the ways in which these may be utilised commercially, and so forth. Last, there falls especially to be described in detail the various diseased and pathological conditions with which the inspector of meat may come in contact, in British markets and abattoirs especially. This last division of our subject is of great importance, since inspectors in the past have been largely dependent upon Continental descriptions for this information, and there are many important differences between such descriptions and the conditions which the meat inspector in Great Britain will commonly find. Some pathological conditions which are common in some parts of the Continent are extremely rare in our own country, and *vice versa;* and the methods of inspection adopted in various parts of Great Britain are entirely different from those met with abroad.

The Desire for Scientific Knowledge. Neither the industry nor meat inspection has up to the present time received anything like the scientific attention which its importance deserves in this country, but there are many obvious indications that this state of apathy is rapidly passing away, and there is a real desire on the part of those engaged in the meat industry to possess a thoroughly scientific knowledge of the different parts of their business. One of the most gratifying indications of this desire is to be found in the success which has attended the formation of classes and courses of lectures in various educational centres. Those of us who are officially connected with teaching institutions which deal with animals and disease are particularly well able to judge of this tendency on the part of those engaged in the meat industry, and our experience is that applications for lectures or courses of lectures dealing with the practical aspects of the meat trade and its management are becoming more and more frequent, and the interest taken in them greater and greater.

It is hoped that these pages will, to some extent, supply the needs of those engaged in this occupation by giving most of the information required.

Where Britain lags Behind. The subject of meat inspection itself has not received, by any means, in Great Britain the attention which it undoubtedly deserves, with the result that in this respect we are lamentably behind other civilised nations. This is the more curious when we realise that the English-speaking peoples are amongst the greatest consumers of meat as an article of diet.

The subject is gradually becoming recognised as one of immense importance from the municipal, the national and the international standpoint, and there can be but little doubt that during the next few years—it would be rash to say how many—there will be some attempt on the part of the authorities in this country to put our house in order in the matter of meat inspection. One would fain hope that the time will not be far distant when every single animal which is slaughtered for the purpose of human food will have to be scientifically inspected by a properly qualified inspector appointed for that purpose, before the meat is exposed for sale. When that time arrives, it follows that the demand for skilled inspectors will be a large one, and when it is thoroughly recognised what the training for such a duty really involves, there can be no doubt that few, if any, except qualified veterinary surgeons, will be allowed to hold such appointments.

The Inspectors of To-day and To-morrow. It will be very soon recognised—as it is already recognised by those who are most intimately connected with the industry—that it is absolutely necessary for a modern meat inspector to have had a thorough scientific training, and that it is not by any means sufficient for him merely to be able to detect in an empirical manner meat which is unfit for human consumption. It has been the custom in the past, and still is in many places, to appoint as inspectors what are termed " practical men " ; in other words, men who have been brought up in one or other branches of the meat industry, frequently as butchers, and who have learnt by long experience to recognise good meat from bad. We have not a word to say against such men who, as the result of long years of this work, have gained a great amount of practical knowledge, and we know many who are extremely capable in this direction ; but it is a method of training which is not applicable to the great mass of inspectors who will be required as soon as meat inspection is put upon a proper footing. Every one knows the knowledge so gained takes too long to acquire ; and, in the second place, the meat inspector of the future must have a thorough scientific knowledge of pathology and bacteriology, and an adequate training in modern laboratory methods, which in the case of diseases of animals can only be obtained at one of the recognised veterinary colleges. Moreover, the inspector of to-day and to-morrow has to deal with a number of complex problems, principally due to the immense development of the import trade in meat, which his predecessor, a few years ago, did not encounter. He has to deal with an immense variety of tinned, canned and other preserved food-stuffs, and, in fact, in order to be competent to carry out his work he must be prepared to specialise in his subject. In all these aspects of the meat industry it is hoped that the following pages will be of some assistance to the inspector in placing before him the information which he needs. In the section devoted to the meat inspection in the various large centres of the meat industry we have endeavoured to give an account of the methods at present adopted, and an idea of the duties of the inspectors, so that those who are preparing themselves for this important work will be able to form some conception of what their work will be. It is hoped also that this section will be of value from the point of view of the study of comparative methods.

The Country's Meat-supply. The word "meat" as used in these volumes is understood to mean any part of an animal which is used for human food. It is not restricted to flesh, but includes all the other tissue elements besides muscle, such as fat, skin, glands and any other tissue elements which find a place in any of the other processes connected with the industry. There are, therefore, a very great number of sources from which the meat-supply comes, and in considering the plan to be adopted in any discussion of this kind it is first of all necessary to decide which species of the animal kingdom shall be considered as coming within its limits. It is obviously quite impossible to deal with every conceivable kind of living creature which might by some chance or other come to be partaken of as food, and the principle which we have adopted is to consider only those animals which are *usually found exposed for sale as human food,* either in the markets in our towns or in the shops of our meat-purveyors, poultry-dealers and fishmongers, including in these latter the purveyors of the various kind of game. By restricting ourselves to what is found in these places we arrive at the normal meat-supply of the country with which we require to deal, and that with which the industry is concerned. In this way also curiosities of the food-supply are omitted, and, since we are considering meat from the point of view of the inhabitants of the British Isles, there is no necessity to consider horse-flesh, except in so far as it is necessary to distinguish it from other kinds of meat.

Cattle, Sheep, and Pigs. What, then, are the actual animals which fall to be considered under such a scheme? This will include first of all the various breeds of cattle which are grown for the production of beef, whether at home or abroad, since those abroad are shipped to this country in immense quantities in the form of frozen or chilled beef. It does *not* include the breeds of cattle which are raised particularly for *dairy* purposes, that being a branch of the subject of national food-supply which is much too large to enter upon in these pages, and to which, therefore, we shall make no reference. It includes, in the next place, the various breeds of sheep which are raised for the production of mutton and lamb, either in Great Britain or in other countries. It does *not* include such breeds of sheep as are raised especially for the value of their wool, though in many cases, of course, the endeavour is to breed what is known as a "general purpose animal," and such breeds are part of our subject. Next, with regard to the pig, there is practically no difficulty, since the breeding of all races of swine is primarily and essentially for purposes of food-supply. We shall, therefore, refer to all the principal varieties of pigs, and there is no part of our subject, either from the point of view of the industry itself or that of its inspection, which demands closer attention. So much for the large animals which constitute the three main sources of the meat-supply, namely, cattle, sheep, and pigs.

Poultry and Fish. But these animals by no means completely exhaust the list of those from which we obtain meat, for in addition to what are popularly termed "beasts" we have also to consider the birds and the fishes. In the group of birds it is chiefly poultry with which we are concerned, and also those birds which are grouped together under the general term of "game," though this latter, of course, also includes a certain number of mammals such as hares and rabbits. We shall turn our attention to the special diseased conditions of poultry and game which render them unfit for human food, and point out the general principles and detailed signs by means of which it is possible to judge of the condition of the dead bodies of these creatures. Finally, in this connection there remain the fish, an aspect of our subject which is of immense importance, whether considered from the point of view of the enormous size of the industry involved or from the serious results which follow when unfit specimens are retailed for human food. This is a part of our subject to which the meat inspector of the future will be required to devote far more attention than he has done in the past, and, as will be seen later, we have here recognised this importance by devoting a considerable space to it. We shall consider briefly all the various species of fish which are to be found in their respective seasons in the fish-markets and shops, pointing out the various characteristics which serve for their recognition, and drawing attention to any special points in connection with the various species which render them particularly liable to become dangerous food. In this group, too, must be placed, for the sake of convenience, the shell-fish such as oysters, mussels, lobsters, shrimps and so forth, which constitute a considerable portion of the food in some parts of the country.

Other Sections of the Work. We have already stated that it is our opinion that the expert in the meat industry, and the meat inspector, must henceforth be regarded as a scientific specialist, and we shall keep that view in mind in our dealing with this whole subject. In other words, we shall assume that it is the desire of the man who is devoting his attention to any part of this great subject to make himself thoroughly familiar and acquainted with all that is of importance or interest in his life's work. For that reason we shall include remarks dealing with meat as a food, which at first sight might not seem to be absolutely necessary in a work of this kind. We would not maintain that it is absolutely necessary, but we certainly hold that the man who is specialising in any part of the meat industry ought to wish to be familiar with the value of his commercial raw material as a food-stuff. The question should at least interest him, and we trust that it will do so ; and whether it does or not, it is our opinion that no account of meat would be complete unless it included some reference to the physiological value of that substance as a food, and to the various methods of preparing it for that purpose.

In all these various parts of our subject there is much which may be described as of a statistical nature, which is, of course, inevitable in dealing with any vast commercial enterprise and its management.

Such, then, is the general plan of the following pages ; and though it is not possible to follow it in the order indicated in every particular, still in the main it will be found to coincide with what we have just outlined. We therefore have to turn our attention, in the first place, to the sources of the supply of meat in the meat industry, in other words, to the various kinds of animals from whose bodies we obtain the supply.

Natural History of Meat Animals. Without entering into any zoological detail, we may just note a few important points in connection with the zoology of the animals which we have to deal with in the meat industry, so that we may have a wide view of our subject as a whole.

By far the most important zoological group, from our point of view, is that of the *Ungulata* or hoofed mammals, to which belong the omnivorous swine which do not ruminate, as well as the cud-chewing animals or ruminants (Ruminantia). In the latter group are the deer, oxen, sheep, goats and their allies. Both of these great groups are even-toed, in opposition to the odd-toed animals such as the horse. The swine are, perhaps, the most primitive members and are widely distributed in the world, their antiquity being shown by the number of their teeth and their preference for marshy ground. Their teeth are adapted for an omnivorous diet.

The cud-chewing animals take their designation from the process of rumination, a peculiar digestive process, which is really a means of swallowing a hasty and bulky meal, and then digesting it at leisure in safe surroundings. The food is brought back to the mouth in successive

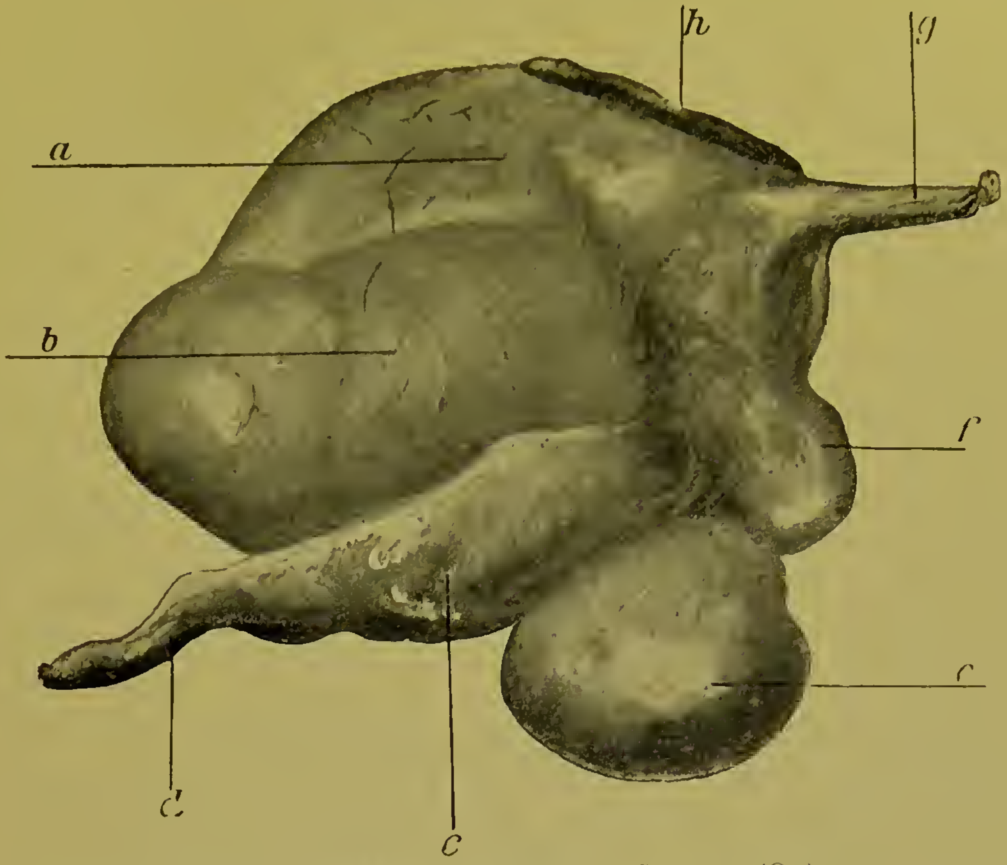


FIG. 1. EXTERIOR OF RUMINANT STOMACH (OX)

a, b. Paunch, rumen. *c.* Abomasum or reed. *d.* Intestine. *e.* Manyplies. *f.* Reticulum. *g.* Gullet. *h.* Spleen.

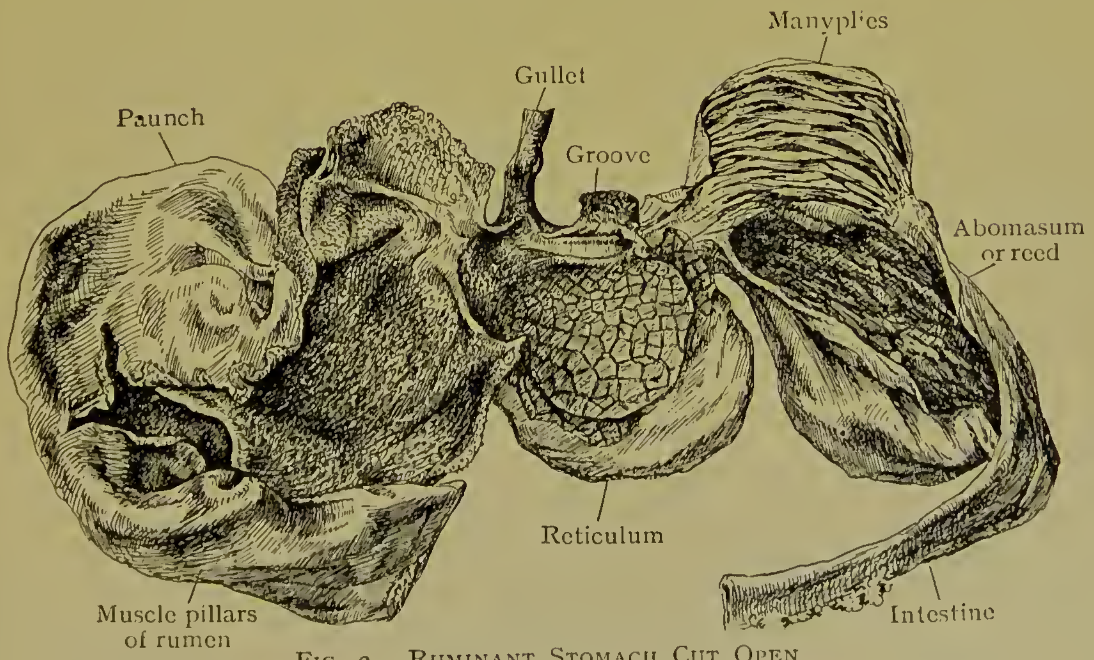


FIG. 2. RUMINANT STOMACH CUT OPEN

boluses to be carefully chewed, swallowed again and digested. This process of rumination demands a peculiar anatomical arrangement of the stomach, and in these ruminants the stomach is composed of four chambers. Parts of this stomach are treated so as to form tripe.

The Ruminant Stomach. This four-chambered stomach consists of (1) the paunch or *rumen*; (2) the honeycomb or *reticulum*; (3) the manyplies or *omasum*, and (4) the reed or *abomasum*. The herbivorous food is first hurriedly cropped without any chewing and passed into the rumen, whence it passes into the reticulum. In this compartment it is made up into the bolus by muscular action and subsequently returned to the mouth. Then it is masticated or chewed, and on being re-swallowed enters the manyplies, the peculiar structure of which is adapted for acting as a strainer. This structure is seen in the multiple folds of the manyplies. From this the food passes to the abomasum, in which the chemical part of the digestive stomach is situated, and here the gastric juice acts upon it. Ultimately, as in other mammalian digestion, the food passes into the intestine, where it is subjected to further digestive action and then is absorbed (Fig. 1).

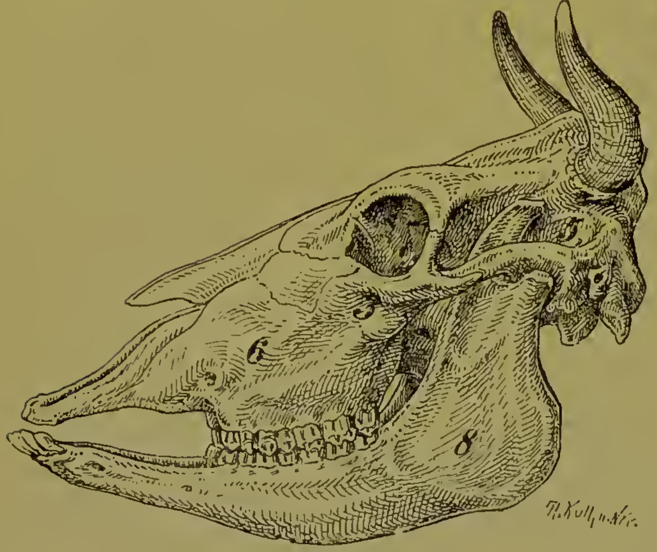


FIG. 3. SIDE VIEW OF SKULL OF COW

3. Malar. 5. Squamous temporal.
6. Sup. Maxilla. 8. Mandible.

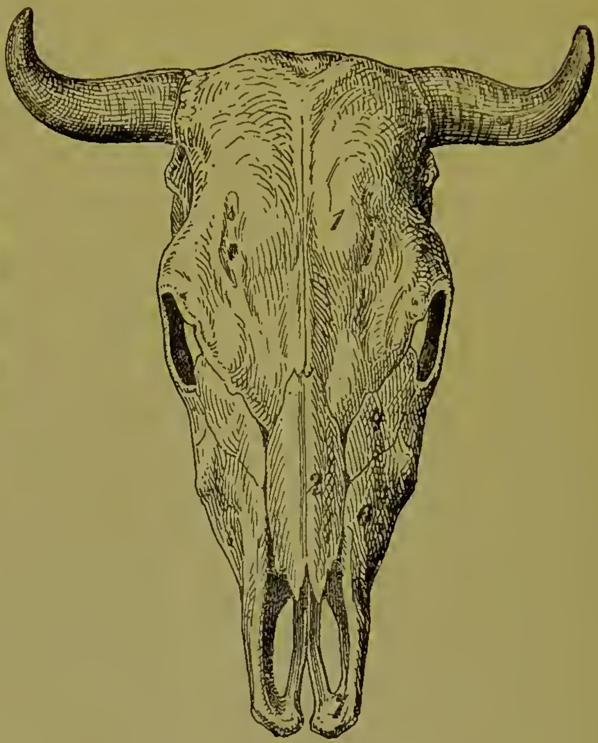


FIG. 4. FRONT VIEW OF SKULL OF COW

1. Frontal. 2. Nasal. 3. Malar.
4. Lacrymal. 6. Sup. Maxillary.
7. Pre-maxillary.

The Teeth in Ruminants. Corresponding to this highly specialised digestive process we find a peculiar arrangement of the teeth. In all the ruminants which come under our notice the upper cutting teeth have disappeared. Thus, in the ox the lower front cutting teeth bite against a horny pad on the upper jaw. The grinding teeth have flat crowns with a complex arrangement of ridges, which enable them to do the chewing efficiently (Fig. 3).

The Rodents. To this order, which is also an ancient and widely distributed one, belong the gnawing animals, mostly of small size and adapted for feeding upon vegetables chiefly. We have to note only the rabbits and hares. They possess four chisel-edged front incisor teeth, which are continually growing throughout the life of the animal.

The Birds. Concerning this group of food creatures we need only say that they have blood which is several degrees hotter than that of the mammals, the digits of the hand are reduced to three (there being no fourth or little finger represented in the bones of the wings), and there are never more than four toes in the foot (the little toe being absent). No birds belonging to existing species possess teeth. There are two great divisions of birds, namely, the *carinatæ,* or flying birds, and the *ratitæ,* or running birds. The birds chiefly used for food belong to the following orders: *Columbæ,* or pigeons; *Gallinæ,* or game-birds; and *Anseres,* or ducks and geese.

The group of game-birds is of most interest to us, since it includes pheasants (*Phasianidæ*), guinea-fowls, turkeys, common fowls, quail, partridge, capercailzie, black grouse, red grouse, and ptarmigan. It is of interest to note that of all the ten thousand or so of existing species of birds there is only one, the red grouse, which is restricted to Britain. The pheasant family are found native in most parts of the world; the guinea-fowl came from a West African species; turkeys originate from North America; and the common domesticated fowls had as their ancestors the red jungle fowl of South Asia.

The *Anseres,* which include the extensive family of ducks, geese, and swans (*Anatidæ*), are cosmopolitan. They are web-footed and have flattened bills. The domestic duck came from the wild duck, and the domestic goose probably from the grey lag. Swans have longer necks and shorter bills than ducks.

The *Columbæ,* or pigeons, are plump birds, with nostrils placed in a bare patch of swollen skin at the base of the beak. Their food is chiefly vegetable and the digestive tract arranged accordingly. The crop is large and acts as a temporary stomach. The feet are adapted for perching on trees, only the first toe being turned back, but the feet are also suitable for moving on the ground. While young ducks can run from the nest as soon as they are hatched, young pigeons are born naked and helpless. There are four British species of pigeons, and all the domesticated breeds have arisen from artificial selection. The rock-dove is the ancestral stock.

The species of fish which come under our notice as food are so numerous and differ so much from one another that we have devoted a special descriptive section to them in another part of this work (*see* chapters ix. and x.).

With these few preliminary remarks we may at once turn our attention to the various breeds of cattle, sheep, pigs, and the species of fish, reserving, for the sake of convenience in arrangement, the self-contained section on poultry.

CHAPTER II

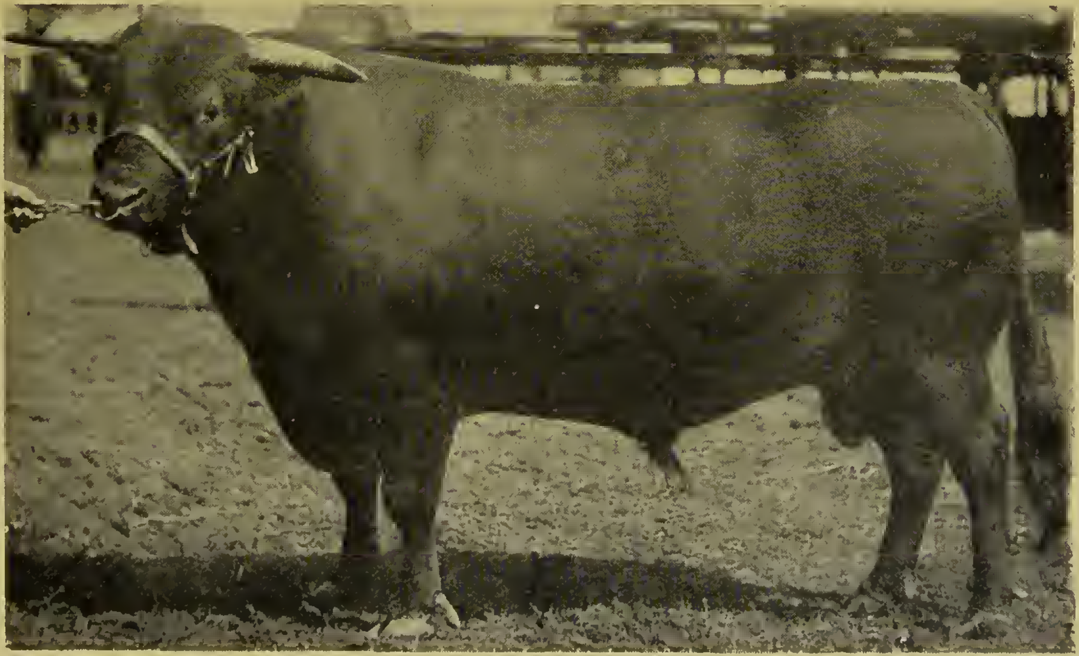
BREEDS OF CATTLE FOR BEEF PRODUCTION

It would be clearly beyond the scope or purpose of this work to enter into a detailed consideration of all that is known concerning the origin of the various types and breeds of cattle as we now know them, and all the steps which have been taken to bring them to their present condition.

Pan of the Burn. Birmingham and Smithfield Champion, 1909

That subject belongs to the literature of the history of cattle and has been thoroughly dealt with by various authorities on the subject, to whose works we refer the reader. A list of the principal books will be given at the end of this section. All that is necessary for our purpose is to give in a brief space a short account of each of the principal types of cattle used in the modern meat industry for the production of beef, taking for guides in this matter the description given by those identified with the breeds concerned, either as breeders or as salesmen.

Prize Shorthorn Bull, Royal Duke
The illustration shows the animal's wonderful hind quarters.



Prize Welsh Bull, Wern Emperor

SHORTHORN CATTLE

We may begin with this well-known breed as representing the type of cattle which are perhaps the most numerous of all in Great Britain and extremely numerous also in America, into which country they were imported in 1783 and at intervals onwards, until in 1833 a special company, the Ohio Importing Company, was formed for the purpose of promoting the interest of agriculture and introducing an improved breed of cattle. An agent was appointed to come to England to select cattle for the purpose of the company, and after investigating those which he considered most adapted for the purpose he decided to restrict his purchases to Shorthorns. In the Argentine, Shorthorns are practically the only kind of pedigree cattle grown, and when it is remembered that a tremendous quantity of meat is now imported into this country from that part of the world, it will be realised that the Shorthorn occupies a very prominent position in the meat industry.

A Typical Shorthorn Bull's Head, Meteor

The breed, however, owes its widespread popularity partly, no doubt, to the fact that they have long been considered as being eminently suitable both for beef production and dairy purposes. The cows make excellent milkers, whilst those who are specially interested in fat stock find the Shorthorn an excellent animal for their purpose. So it has come about that many who are interested in the milk industry purchase Shorthorn cows after calving, and after fattening them for some months afterwards find that they are in excellent condition for the purposes of the butcher, just about the time that their milk-supply begins to get less.

Moreover, apart from the pure-bred Shorthorns, it is found that crosses with the Aberdeen Angus, the Galloway, the Ayrshire and some other breeds are extremely good types for various purposes. So it has been stated by a writer on the subject (Mr. D. Young) that the excellence of the Shorthorn for the production of milk and meat, and also for crossing purposes, is the great secret of the world-wide popularity of the breed. The highest prices that have ever been paid for any class of cattle have been paid for pedigreed Shorthorns, and, apart from pedigree altogether,

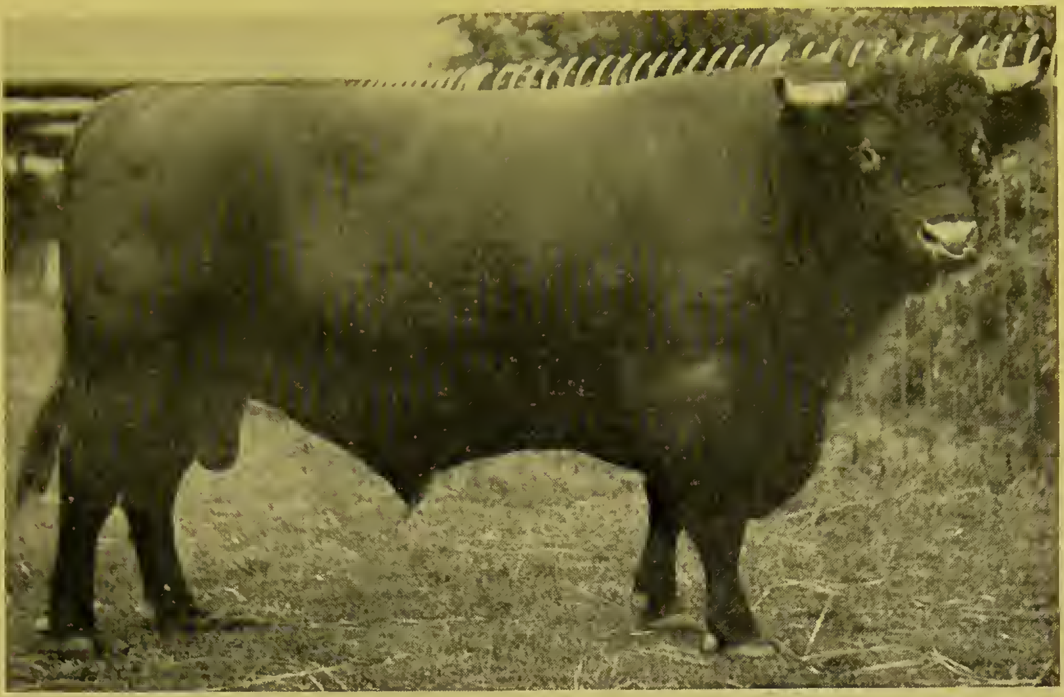
A Champion Shorthorn Steer

The property of his Majesty the King, attended by Uriah Robbins, for over thirty years herdsman at the Royal Farm, Sandringham.

good commercial cattle of the Shorthorn breed or cross never fail to realise satisfactory prices.

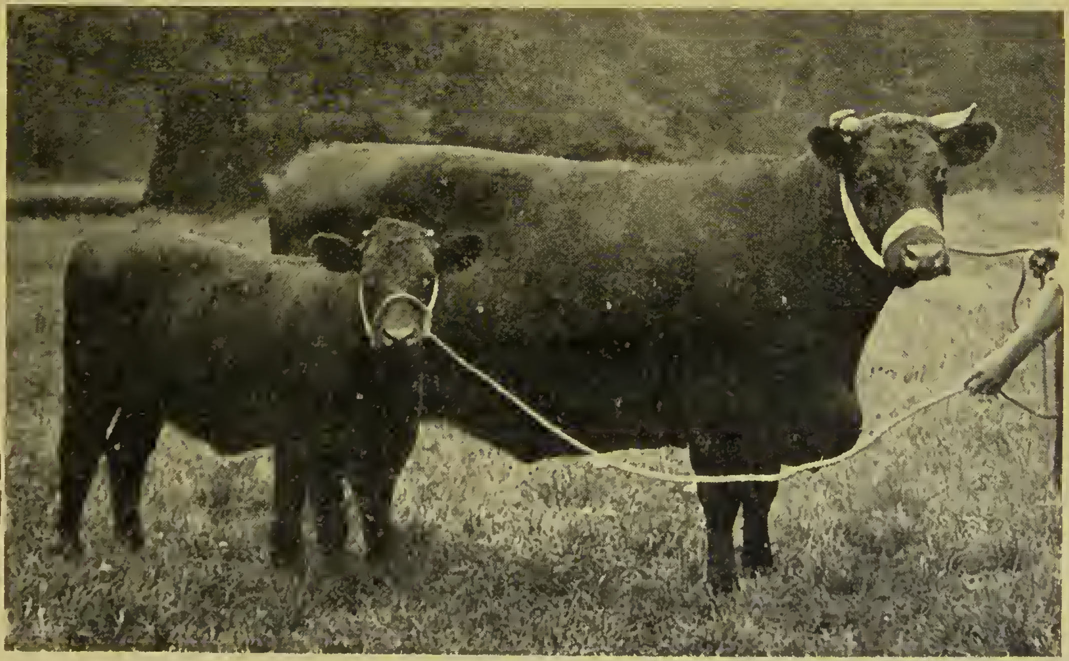
Illustration Showing the top of a Shorthorn Bull

The Origin of Shorthorns. The modern Shorthorns took their origin of breed in the north-east of England, their ancestors going by the various names of Durham, Tees-water, Yorkshire, or Holderness, all of which names referred to the original breed of cattle which first became popular in the north-eastern counties. This local breed is generally thought to have been produced from a cross between British cows and Dutch and Danish bulls, probably less than 200 years ago. Whatever the origin, the breed very soon became extremely popular in Great Britain, until in the nineteenth century at an early date they were the most numerous breed in the country. The description of the points of the modern Shorthorns is thus summed up by Mr. John Thornton, a well-known English salesman of this particular breed: "The breed is distinguished by its symmetrical proportions and by its great bulk on a comparatively small frame, the offal being very light and the limbs small and fine. The head is expressive, being rather hard across the forehead, tapering gracefully below the eyes to an open nostril and fine flesh-coloured muzzle. The eyes are bright, prominent, and of a particularly placid, sweet expression, the countenance being remarkably gentle. The horns (whence comes the name) are, by comparison with other breeds, unusually short.



The Champion Lincolnshire Red Shorthorn Bull, Scampton Exile

They spring well from the head with a graceful downward curl, and are of a creamy white or yellowish colour, the ears being fine, erect and hairy. The neck should be moderately thick (muscular in the male) and set straight and well into the shoulders. These, when viewed in front, are wide, showing thickness through the heart, the breast coming well forward and the fore legs standing short and wide apart. The back among the higher-bred animals is remarkably broad and flat ; the ribs,



The Champion Lincolnshire Red Shorthorn Cow, Keddington Skipworth 5th, with Calf barrel-like, spring well out of it and with little space between them and the hip-bones, which should be soft and well covered. The hind-quarters are long and well filled in, the tail being placed square upon them ; the thighs meet low down, forming the full and deep twist ; the flank should be deep so as partially to cover the udder, which should not be too large but placed forward, the teats being well formed and square set and of a medium size ; the hind legs should be very short and stand wide and quite straight to the ground. The general appearance should show even outlines. The whole body is well covered with long soft hair, there frequently being a fine undercoat, and this hair is of the most pleasing variety of colour, from a soft creamy white to a full deep red. Occasionally the animal is red and white, the white being found principally on the forehead, underneath the belly, and a few spots on the hind-quarters and legs ; in another group the body is nearly white with the neck and head partially covered with hair, whilst in a third type the entire body is most beautifully variegated, of a rich deep purple or plum-coloured hue. On touching the beef points, the skin is found to be soft and mellow as if lying on a soft cushion. In animals thin in condition a kind of inner skin is felt, which is the 'quality' or handling indicative of the great fattening propensities for which the breed is famous."

Colour of Shorthorns. From the colours which have been mentioned in Mr. Thornton's description, and which have long been associated with the Shorthorn, this breed has frequently been called "the red, white, and roans." It may be mentioned that animals which are entirely white are not popular with foreign buyers, and since these gentlemen largely regulate the prices which are paid for pure-bred stock, they also, to a considerable extent, control the fashion in colour. For their purposes the reds or dark roans are preferred. But breeders have found that it is a comparatively simple matter to regulate the colour production by judicious mating. The roan colour is almost distinctively a Shorthorn colour, and may always be taken as indicating the Shorthorn blood. The horns themselves, which give their name to the breed, are short and blunt, curving downwards, of a yellow colour without any black on the tips, flattened somewhat from side to side, giving an oval shape when cut across, and set wide apart from the head.

Famous Shorthorn Strains. The two great strains of Shorthorn cattle which originally were most famous were those bred by the families of Bates and Booth, which gave rise to the saying "Booth for the butcher, Bates for the pail," indicating that these breeders had developed their cattle along the two lines of the meat industry and the dairy produce, but, like many fashionable sayings which became proverbial, it was only partially true. A full and most interesting account of the operations of these and other breeders during the last century or more will be found in Professor Wallace's well-known book on "Farm and Live-stock of Great Britain."

Shorthorns in 1909. Mr. Frank P. Matthews writes thus (*Live-stock*

Prize Dexter Kerry Bull, Cowbridge General

Journal Almanac, 1910) of the present position and prospects of the breed:

"The past season may, on the whole, be considered quite a satisfactory one for Shorthorn breeders, and there have been several interesting features in the trade of the year.

"It is now about two years since the demand for great numbers of both bulls and females for the Argentine began to show signs of falling off, and although both the breeders in South America themselves, as well as their agents, have searched the kingdom through to find animals of the highest class, and were still willing to pay handsome prices for them, they have not taken anything like the quantity that were exported in the years 1905, 1906, and 1907, which were undoubtedly the most profitable seasons that breeders in general have ever experienced in this country. The slackening in the Argentine demand has, without question, been the chief reason of the somewhat overcrowded market of the year, but

Prize Dexter Kerry Cow, Compton Dot

against this there is a point that may be regarded with great satisfaction. For a long time past the industry and attractive occupation of Shorthorn breeding has been taking a firm hold of a great number of new breeders, recruits springing up in all parts of the United Kingdom. The majority have, needless to say, been attracted by the high prices paid by our good foreign customers, but there are also signs of more enterprise among the farmers, who have been good supporters of the sales; besides which many fresh herds have been started by gentlemen of capital, who it is to be hoped are realising the fact that the development of our pure breeds of live-stock is the mainstay of the cattle-breeding industry of the country. There has been a steady increase in the membership of the various breed societies, the Shorthorn Society particularly having made great progress. After the decline and fall of the 'in bred' Bates, Booth and other strains, breeding was generally carried on for a considerable period without any direct method, breeders not knowing apparently what line to take or what system to adopt; but of late there has been more interest taken in pedigree, and a growing inclination to study breeding; the largely increased demand for certain families and strains of blood being the best evidence of this, and so long as it is not carried too far the breed should benefit by it."

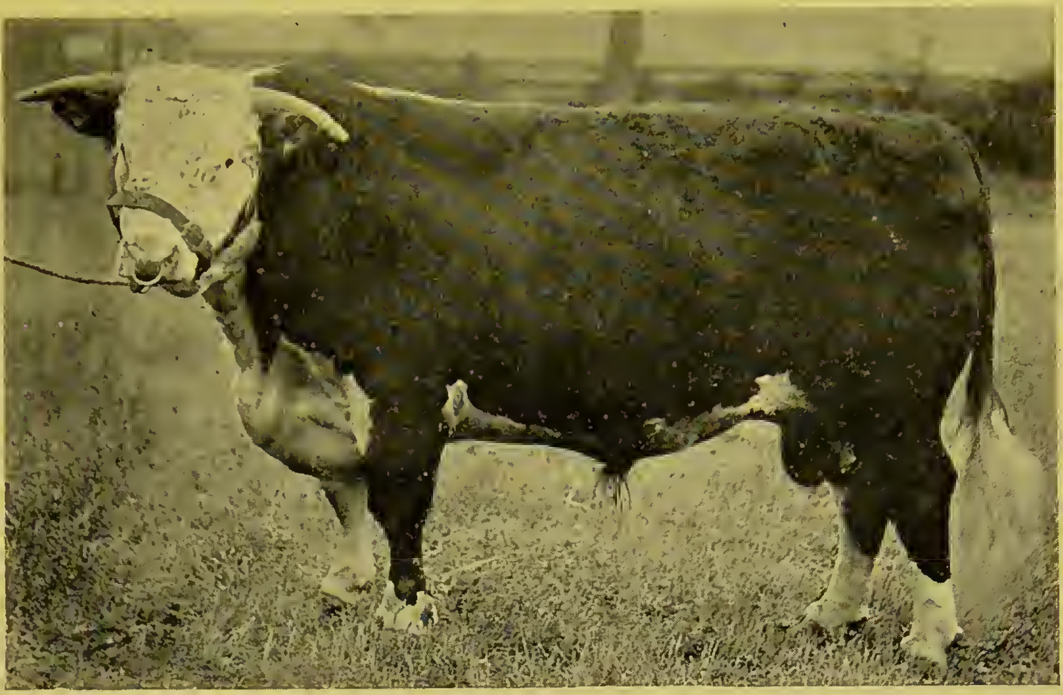
Lincolnshire Red Shorthorns. This type of Shorthorns is especially adapted for dairy purposes, being distinguished by its length of frame, good constitution, great hardiness, capacity for milk and great weight of carcase. But since the variety is becoming one of the most popular milking strains, we need not refer more particularly to it here.

Dexter Shorthorns. These took their origin in Ireland as the result of the crossing of a Dexter heifer with a pedigree Shorthorn bull, the result having produced a strain of excellent milkers which also put on flesh rapidly if left idle. Doubtless milking qualities are derived from the Dexter side, while the capacity of beef growth comes from the Shorthorn.

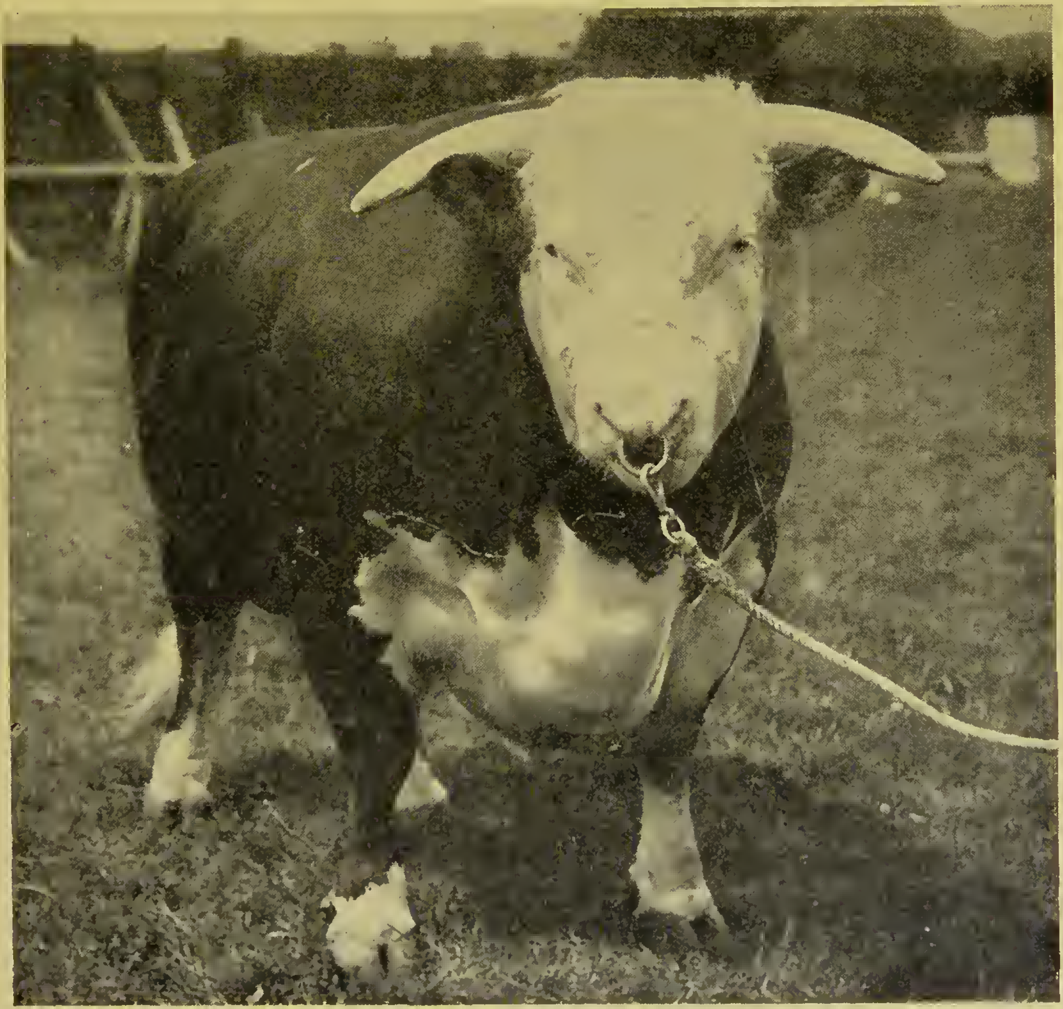
The Shorthorn Society. This is one of the breeds which has a specia organisation devoted to its interests, known as the Shorthorn Society, which issues two volumes every year giving full information regarding the pedigrees of the animals. The secretary is Mr. E. J. Powell, 12 Hanover Square, London.

HEREFORD CATTLE

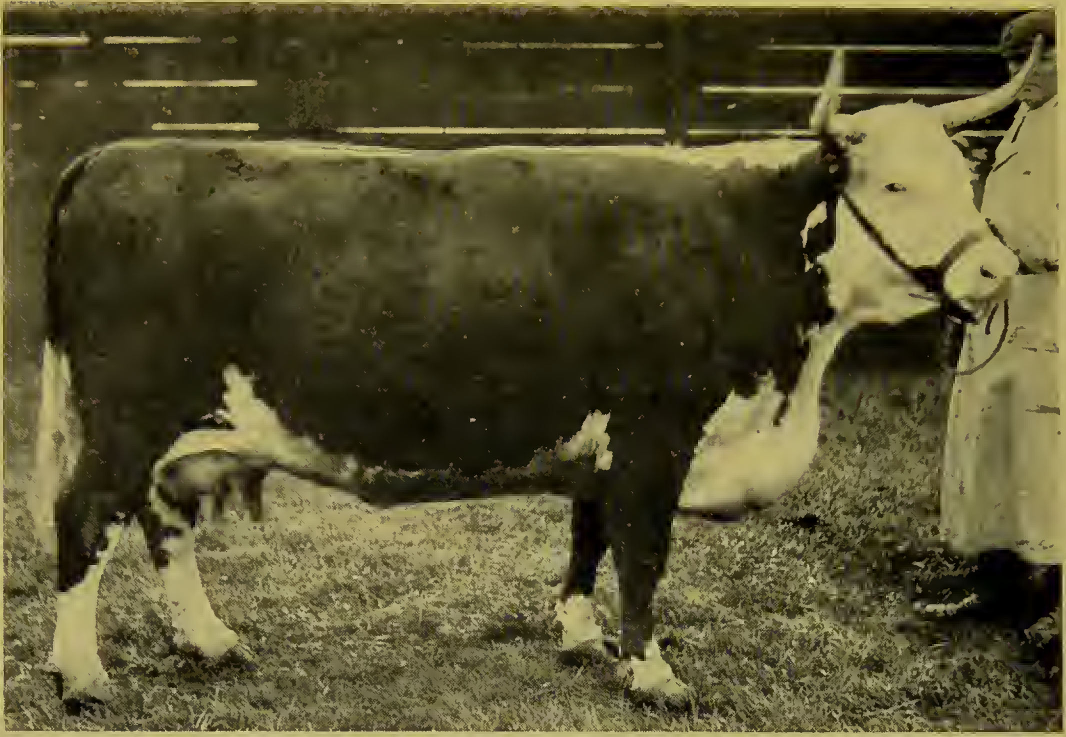
This well-known and popular breed of cattle, although possessing certain similarity in colour with the cattle of Devonshire and Sussex, as well as having affinities with the yellowish and old Gloucester, has been bred in a state of purity for perhaps as long as any of the modern recognised breeds. At any rate, there was in 1788 a distinctly pure breed of cattle in Hereford, whose "colour was a metal-red with a bald face, the last being esteemed characteristic of the true Hereford breed" (Marshall, 1788).



A Champion Two-year-old Hereford Bull, Shelsley

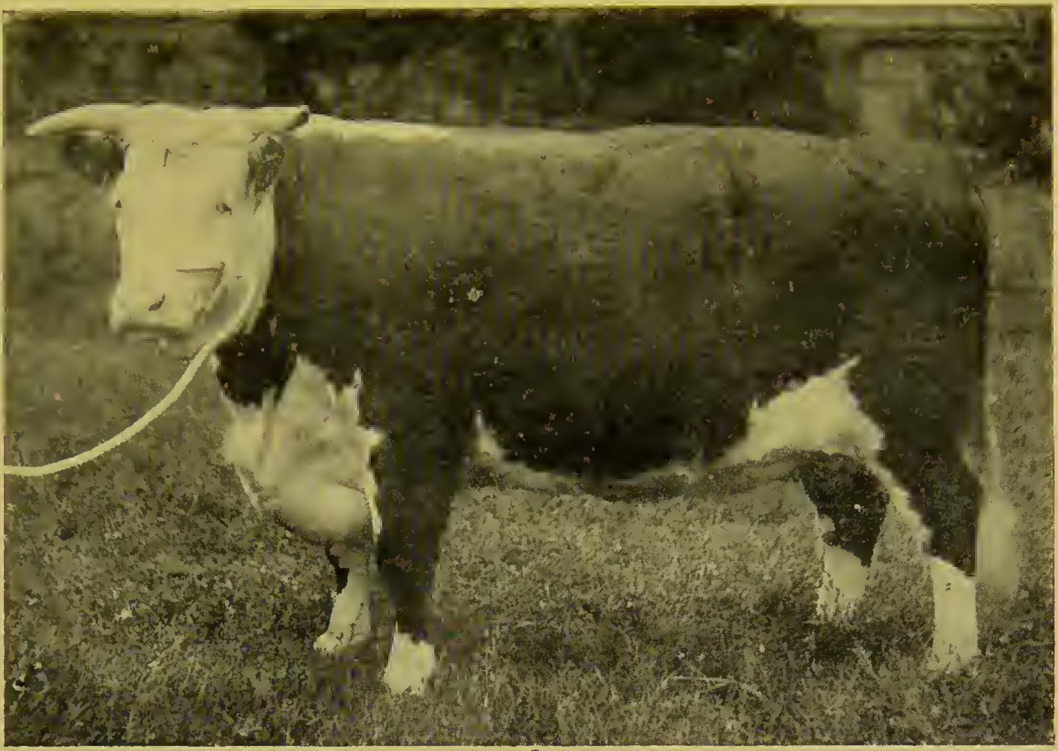


Endale, Champion Hereford Bull: A Good Front View



Prize Hereford Cow, Madame

Points of Hereford Cattle. The following description of the typical Hereford breed is from the pen of Mr. John Hill, of Felhampton Court, the well-known breeder of Hereford cattle: "When judging a bull I should look for a good masculine character and a pronounced style and good carriage, which should indicate that he is likely to stamp his progeny with his own form and attributes. A bull without these characteristics is almost sure not to be a good and impressive sire. The head should be well set on, not carried too low or stuck on like a pig's, as some are. It should not be narrow or too long, but wide between the eyes, which should be full and prominent yet mild, showing a quiet disposition and aptitude to fatten. I like a good wide muzzle and a clear nose. Usually a good body follows a good head. The crest should be well developed and have a good white mane. I do not fancy Herefords without some white on their shoulders, although, of course, its absence is no great point against an animal; and I dislike a bull with narrow crops, and think this is a very bad fault, for Herefords are most emphatically a beef breed, and narrow chines are most objectionable where beef is wanted; on the other hand, the narrow chine is a special attribute of the deep milking sorts, for example, the Jerseys. A young bull having good crops, wide between the top of the shoulder-blades, and having a good fore-flank, will, even if he is not quite filled up behind the shoulder, nearly always come in that place as he matures; so that it should not be thought a very great fault if he is deficient there. A good back is a good point that should carry a great deal of weight with the judges. A bad-backed one should be put on one side, as most of the best cuts of beef worth most per pound come from that part. Long, full hind-quarters and well-



Prize Hereford Heifer, Ivington Bess

developed, wide thighs well let down to the hocks, should score many points, and narrow thighs should always be considered one of the greatest faults. I consider quality counterbalances a multitude of other faults, and I should always reject an animal that did not handle well, as, failing this, they can never feed.

"Good hair, and plenty of it, is also a desideratum. I like a beast which stands over plenty of ground, and with his legs well outside him, the belly-line as close to the ground as possible without being 'tubby.' A big bony animal is certainly to be avoided, but a little size as well as quality must be an advantage to all concerned, for when you have done weighing you have done selling."

Points of Cows and Heifers. "In the case of cows and heifers, I like a clear-cut delicate head, with the same features that I mentioned above for bulls, but with a nice feminine character instead of the bull's masculine appearance. A 'gay' head need not be objected to, provided the horns are not cocked up and turned back—'upturned' horns are very different from 'cock' horns. A bull-like, coarse head is the worst kind to my mind, as it gives no style or smartness to the animal. I am not fond of the very dark reds, as I believe those of a lighter colour—not too pale—feed quicker, and are usually of better quality. Beauty of form and symmetry should always be considered by the judges as two strong points in favour of the animals possessing them."

The points specially peculiar in the Hereford cattle are the prevalence of the white colour on the face and anterior part of the back and mane, as well as the throat, also the belly and the inside and lower parts of the legs and the tip of the tail. Most of the body is of the red colour, varying in shade from light to dark, and the hide, which is thick, is well covered with soft glossy hair, with the tendency to curl. These points can be very well seen in the photographic illustrations appended.

The Herefords as Prize-winners. The Hereford cattle have a magnificent record as prize-winners at Smithfield, and stand in the very front rank for their reputation as grazing animals in England.

Professor Wallace says that " as range cattle they are unsurpassed by any other breed, on account of the high quality of their marbled beef, the perfection of their feet and limbs, their activity, docility and hardiness of constitution, together with their adaptability for crossing with other breeds of cattle. The Shorthorn, being first among all breeds of cattle for early maturity, and moreover of a larger build, will, under favourable conditions, attain greater weights at two to three years old, but on many of the open ranges in the western States of America the Shorthorn first introduced has given place as a utility animal to the Hereford ; and in competition with the Shorthorn in Queensland the Hereford has proved more prolific and less prone to disease, while they mature earlier and travel better, and consequently pay better than Durhams, for the reason that the surroundings are better adapted to this particular breed."

Herefords have never been regarded as cows of the very first grade as dairy cattle, although they do possess excellent milking qualities also. In fact, in the dairy herd competition of the Royal Counties Agricultural Society at Bournemouth, in 1905, the third prize went to a Hereford cow.

Lancaster: A Typical Hereford Head

Nevertheless, it remains true that the main object of breeders of Hereford cattle to-day is to produce the very finest quality of grass-fed beef.

Herefords as Grazing Cattle. The one outstanding quality which has made this breed so popular, not only in this country but in

The Champion Hereford Cow, Merriment, with Calf

other parts of the world, is the capacity that they possess for growing into prime beef cattle *on grass alone.* The home of the breed is particularly a grazing one, and it is this capacity which in the first place brought Hereford cattle into such high favour. At the same time the breed does equally well when fed in other ways and responds quickly to fattening foods. Hereford cattle are primarily beef animals, and as such stand in the very front rank, their characteristic of rapidly coming to maturity standing them in good stead in this reputation.

Hereford Cattle in 1909. "The year was a favourable one for breeders of Hereford cattle in so far as the home trade was concerned. With improved prices for beef, this celebrated race of grazing and feeding cattle has been in active demand. There has been a keen inquiry for bulls of a thriving and superior class; prices were high at several dispersions, and steers have been eagerly competed for. In the summer months, when grass-fed Herefords form the chief feature of the metropolitan market, the number offered was large, and for weeks this class commanded the top rates. An extension of breeding has taken place in the counties where the red with white face has always held sway; and in Ireland the breed is also spreading, as it ought to do in a country for which it is so admirably adapted. Exports have not been so numerous, Herefords having suffered from the diminished demand from abroad for all varieties; but, as will be seen, a wider area has been supplied, and it is only a question of time when fresh blood will be required in some of those regions where the Hereford has been received with much favour and where numerous herds have been established, but in which, for the moment, an attempt in the direction of making them self-supporting is being made." (*Live-stock Journal Almanac*, 1910.)

HIGHLAND CATTLE

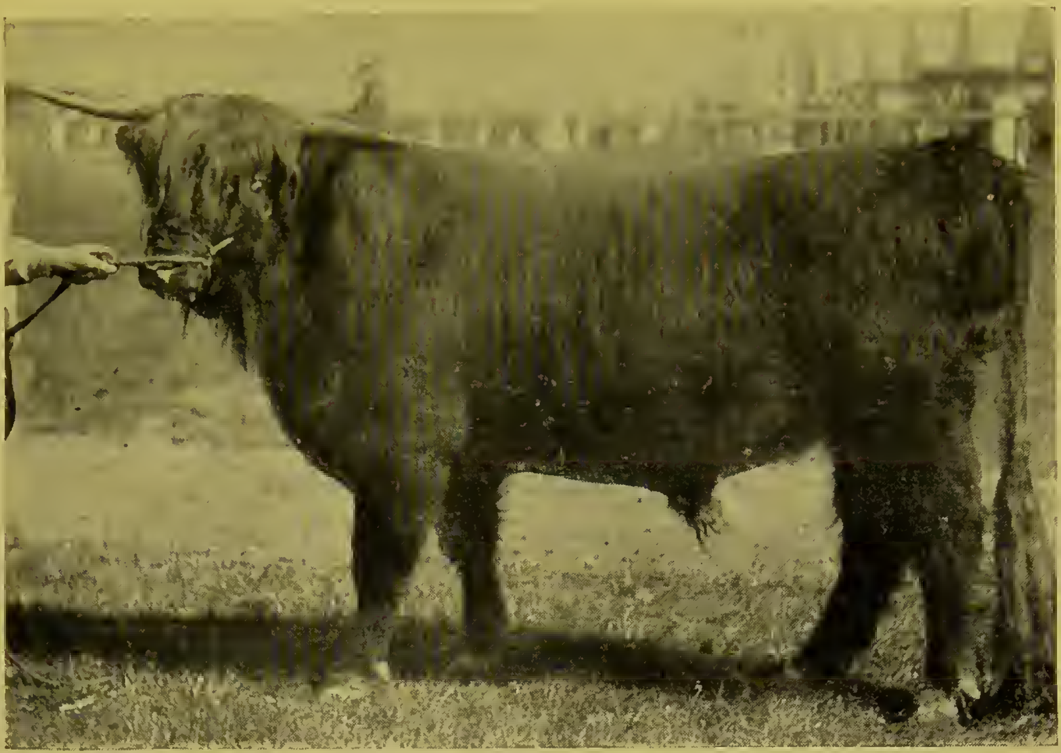
This breed, which comes from the Western Highlands of Scotland, the Outer and Inner Hebrides and from Argyleshire, is considered in Scotland to be one of the oldest and purest of British breeds, and is described by Professor Wallace as the "remaining select representative of the different varieties of Scottish mountain cattle, the domesticated descendants of the ancient breed of the forests." Many classifications of the Highland cattle have been described, but probably all originate in the West Highlands and the mainland cattle, which have since been merged into the present breed. Originally the West Highland breed was black in colour, smaller and shaggier than the mainland Highlander, probably the result of its environment, which was naturally that of a wilder and more rugged nature. Of all the British cattle, the West Highlander is still the most hardy, and, if one may judge from the frequency with which the breed is reproduced in paintings, must be considered one of the most picturesque and artistic of all cattle.

Regarded from the point of view of the meat industry, the bullocks are somewhat slow in reaching maturity, about a year longer than most British breeds, but when maturity is reached the beef which is produced is second to none in quality in the meat market.

Points of Highland Cattle. The following is an eloquent description by Mr. John Robertson : "In form it possesses all the characteristics so much and so justly prized in the Shorthorn—the straight back, the short legs, the broad chest, the breadth of loin and depth of rib, and, in short, the squareness and solidity of form which always imply weight, whether in man or beast ; while the noble expanding horns, the fine, full and fearless eye, the short, broad, well-bred muzzle, the shaggy coat of richest black or red or dun or brindled colour, impart a picturesqueness which is still further enhanced by that grace and deliberation in movement so distinctive of all animals reared in perfect freedom.

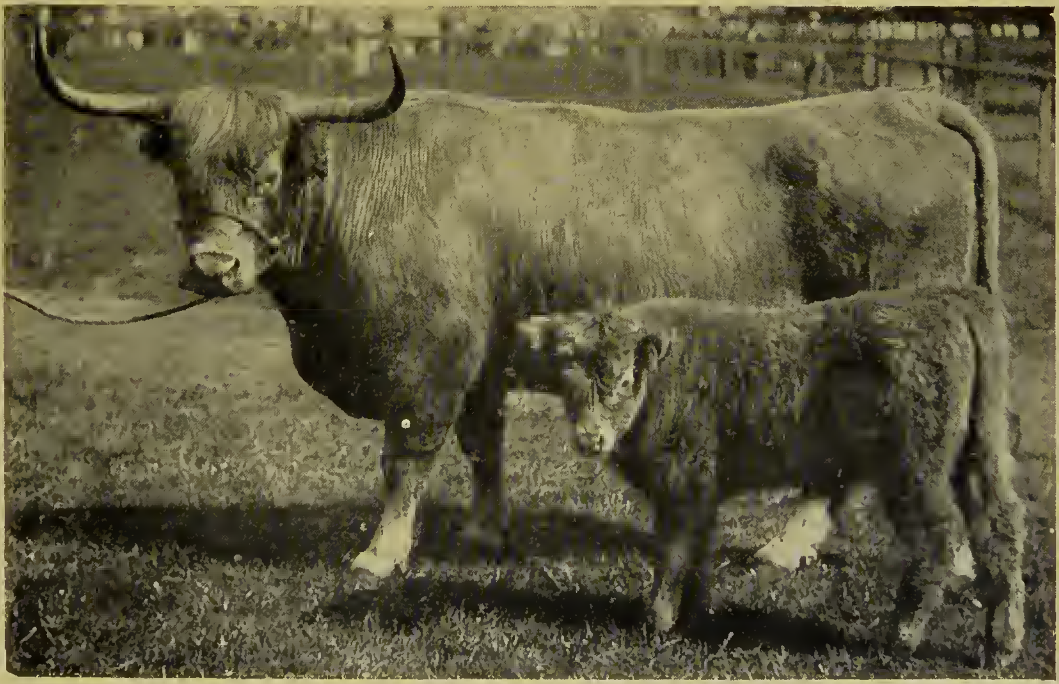
"One of the striking features of the breed, and that which adds much to the picturesqueness, is the quantity of hair, which is specially prominent on the brow, the lower edge of the ear, the ridge of the neck and down the thighs. The forelock between the eyes is woolly, long, and bushy.

"'In the bulls the horns should be sappy and substantial and come level out of the head, slightly inclined forwards and also slightly rising towards the points' ; a dropping off between the crown and the commencement of the curve is 'a very bad fault.' The horns of the cow usually 'come squarer out from the head than in the male, rise sooner and are somewhat longer, though they preserve their substance and a rich reddish appearance to the very tips' ; at times the horns 'come more level from the head, with a peculiar back-set curve, and very wide, which is more graceful in appearance. The neck should be clean and without dewlap from behind the shoulder, the back fully developed and beautifully rounded, any slight sinking or hollow being most decidedly

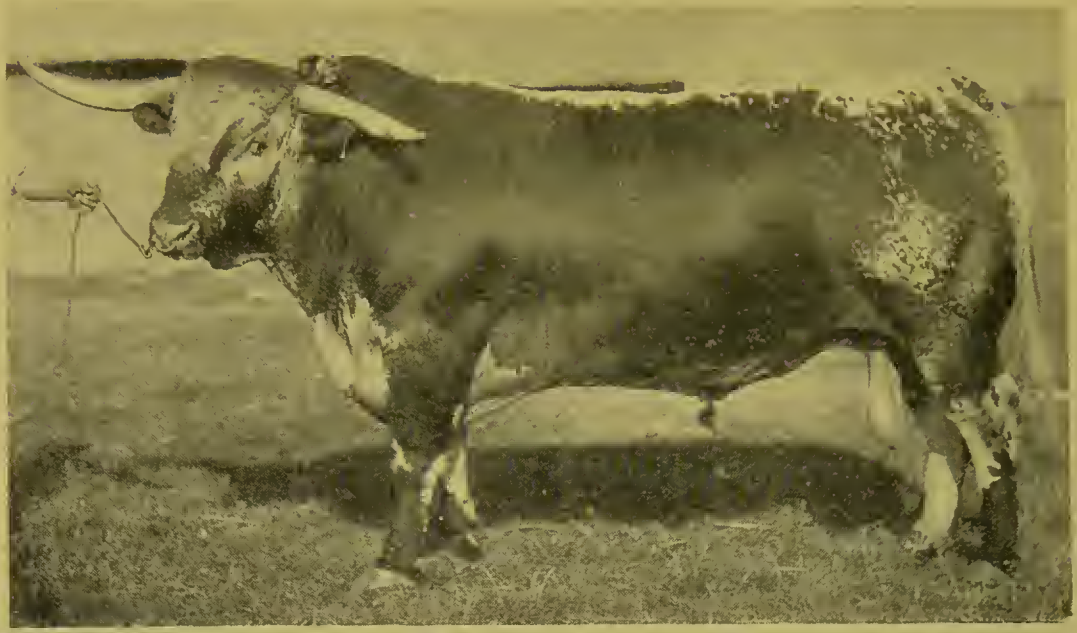


THE CHAMPION HIGHLAND BULL, MORIAR BREHLAICH

objectionable. . . . Viewed generally, the quarters are square between the hips and the tail and from between the tail right down to between the hind feet; the legs short and strong; the bones strong, broad and straight; the hoofs well set in and large, and the legs well feathered with hair.' "



THE PRIZE HIGHLAND COW, MADAME LUNA, WITH CALF



Prize Longhorn Bull, Melcombe Emperor

LONGHORN CATTLE

This breed, which is the remains of one which formerly held a high position for both milking and beef production, apparently came from the western parts of the British Islands. They are common in Ireland and have been there for a very long period, whether they originally came from that country or not.

Points of Longhorns. The breed has been considerably changed in modern times, and is now described by Low as follows:

"The shoulder is well formed, the neck remarkably thin, head fine, and the limbs are moderately short and small-boned, in which respect the artificial differs from the natural breed.

"The skin, though thick, is soft, and the hair is usually reddish brown, with more or less of white on different parts. The ribs are

Typical Devon Head: Capton Royal Sally, a Champion Cow

Prize Longhorn Cow, Bentley Dido

remarkably well arched, forming a fine cylindrical trunk ; the loin is moderately broad, and the hind-quarters are long. The animals are easily maintained on ordinary food and readily fatten. The flesh has never entirely lost that darkness of colour distinctive of the unimproved race, and the fat is less mixed with the muscular parts than in any other kind of British cattle. The tendency of the fat to accumulate on the rump is so great as to produce a kind of deformity in the fattened animal. . . . The fat, too, retains the tinge distinctive of the older race. . . . The cows are eminently deficient in the power of yielding milk. They are in this respect greatly inferior to the older Longhorns, and are scarcely ever used for the purposes of the regular dairy."

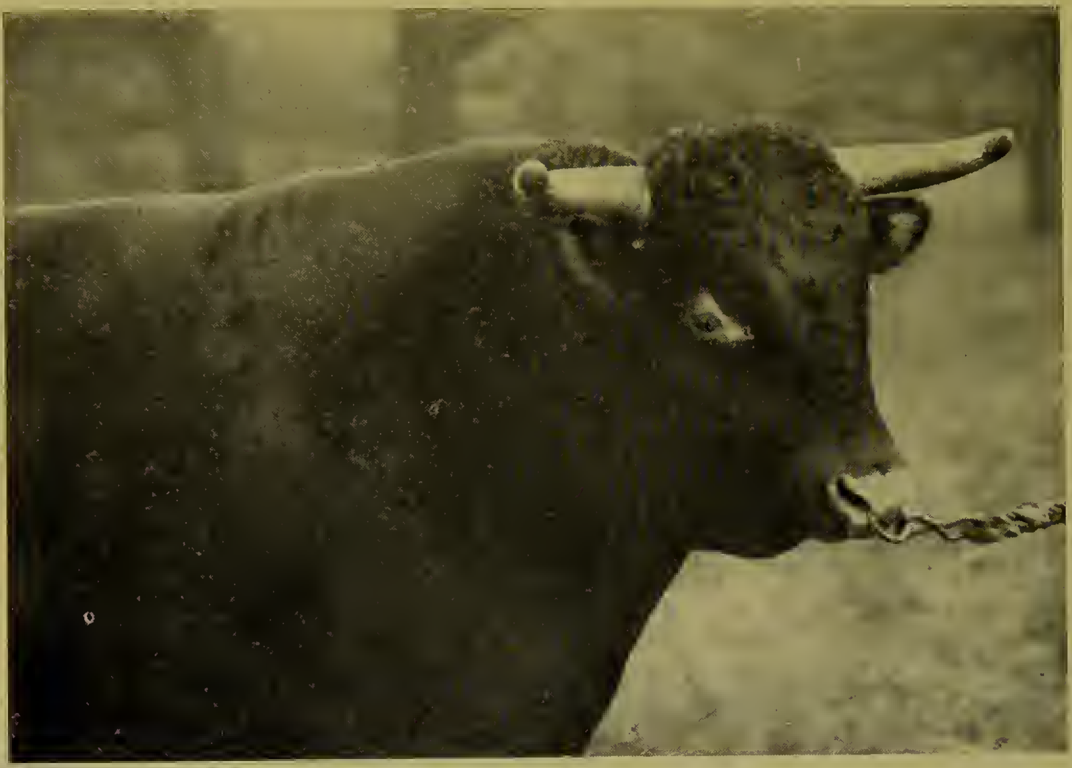
It is not at all surprising that the Shorthorn became more popular than the Longhorn for general purposes. The method of breeding which had been adopted apparently resulted in considerable weakening of the constitution as well as of the loss of muscle, and especially of the milking properties.

About the middle of the nineteenth century the Shorthorns became so popular that in some places the Longhorns were almost extinct, to the disappointment, in some districts, of the local farmers who, when too late, found that the Longhorn had been more suitable to the locality than the Shorthorn.

Professor Wallace remarks that he was personally told, in one district quite recently (1905), by men who had seen the change take place, that they acknowledged they had made a mistake.

As the result of repeatedly crossing with Shorthorn bulls, very little of the Longhorn blood was left in the Fell cattle, and in order to restore the requisite hardiness of constitution to the breed, West Highland bulls were introduced.

The Longhorns of the present day present very marked differences to the Shorthorns, resembling them practically only in their docility of character. In colouring they show a wider line along the back, with a white patch, or mark, on the thigh. Some pure-bred animals are entirely self-coloured, whilst in others the sides of the body are either red, brindled, roan, or any of these colours mingled with small white flakes. The dark brindle, with the white line along the back, is apparently the most popular colour. The coat of such a Longhorn, when in the best of condition, has been described as exhibiting a tint like the bloom of a ripe grape. Then, of course, the length of the horn, which is an irregular sweeping one, is a striking characteristic. In modern times Longhorns have been greatly crossed with Shorthorn, Aberdeen Angus, North Devon, and Jersey cattle, the result being that the female cross is a good milker, while the steers give heavy weights of excellent beef, apparently a better quality than was associated with the Longhorn in its early history. The tendency seems to be for the breed to increase in favour, and it is quite possible that Longhorns will be much increased in number in the near future and take their place as one of the recognised general-purpose breeds of the country. The breed is now well established in the Isle of Man.



A TYPICAL DEVON BULL'S HEAD AND SHOULDERS
H.M. the King's Ben Golsoncott.

DEVON CATTLE

Two branches of this breed are generally recognised under the names, respectively, of the North Devon and the South Devon, the former being the original type of hardy cattle which lived in the north of Devonshire.

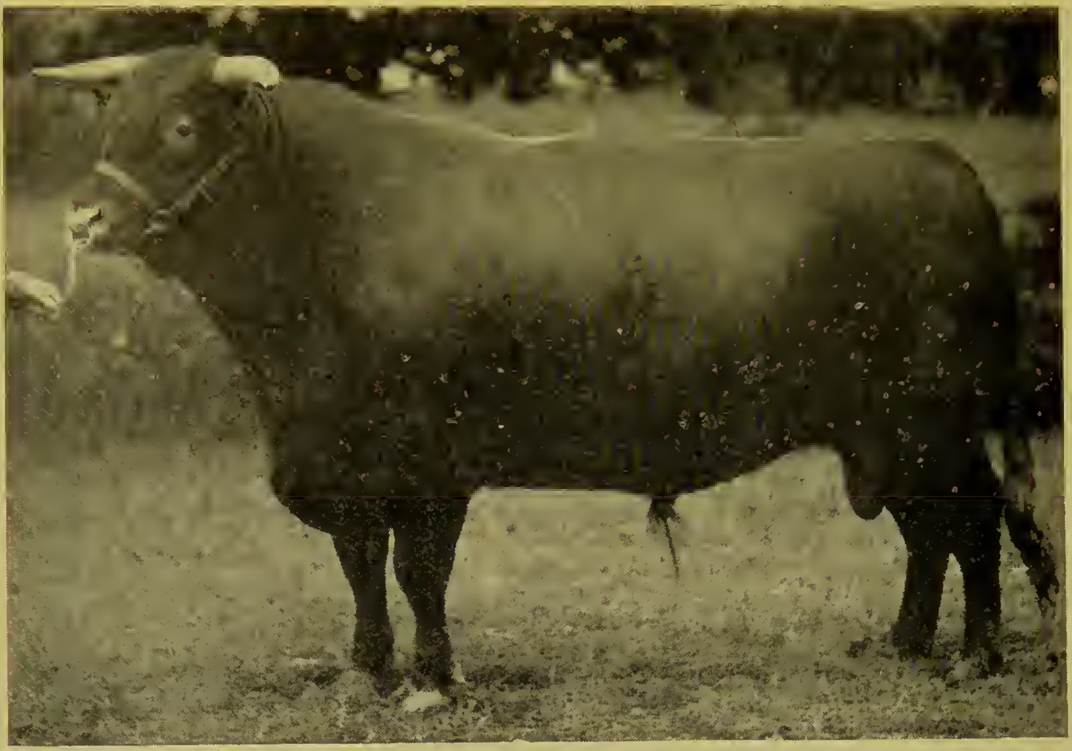
Prize Devon Heifers

The breed is related to both the Hereford and the Sussex breeds, though it is a smaller animal than either. The colour is red all over, or with dappled markings. The skin is yellow except inside the ears, where it is red. There is frequently a small patch of white hair on the belly, and this patch may extend to the fore-legs. The female horns are tipped with black, of moderate length, creamy white in colour, with sharp points curving upwards. They are shorter in the bull and not so curved. As beef-producers they are excellent. The North Devon cattle, of the special type which occur in the county of Somerset, are larger in size, the increase of bone giving an additional coarseness to the figure. The type, however, is increasing in favour.

As would be expected in a breed which was originally nurtured in the mountains, Devon cattle are hardy and strong. They have played

Prize Devon Cows in the Famous Herd of the Hon. E. W. B. Portman, Hestercombe, Taunton

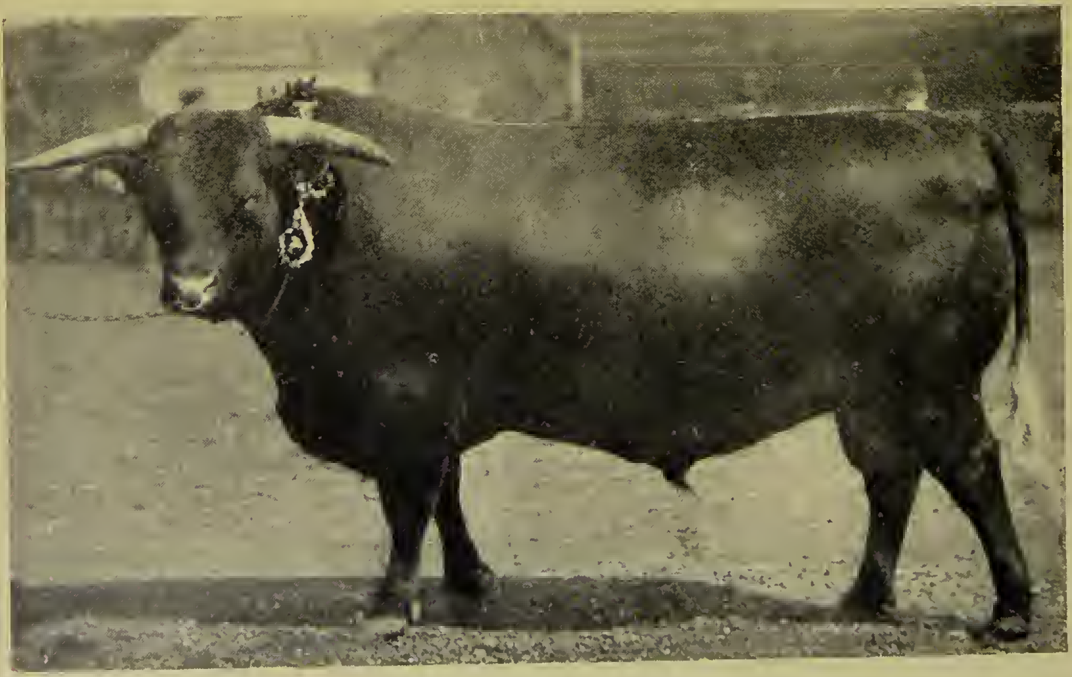
Two royal winners are standing in the foreground.



THE PRIZE SOUTH DEVON BULL, ELECTOR

many parts in their time, being originally in great demand as oxen for draught purposes on farms.

They could never be regarded as excellent from the milking aspect, either from the point of view of quality or quantity, though exceptional animals are found. The foreign demand for these cattle for beef production is extending.

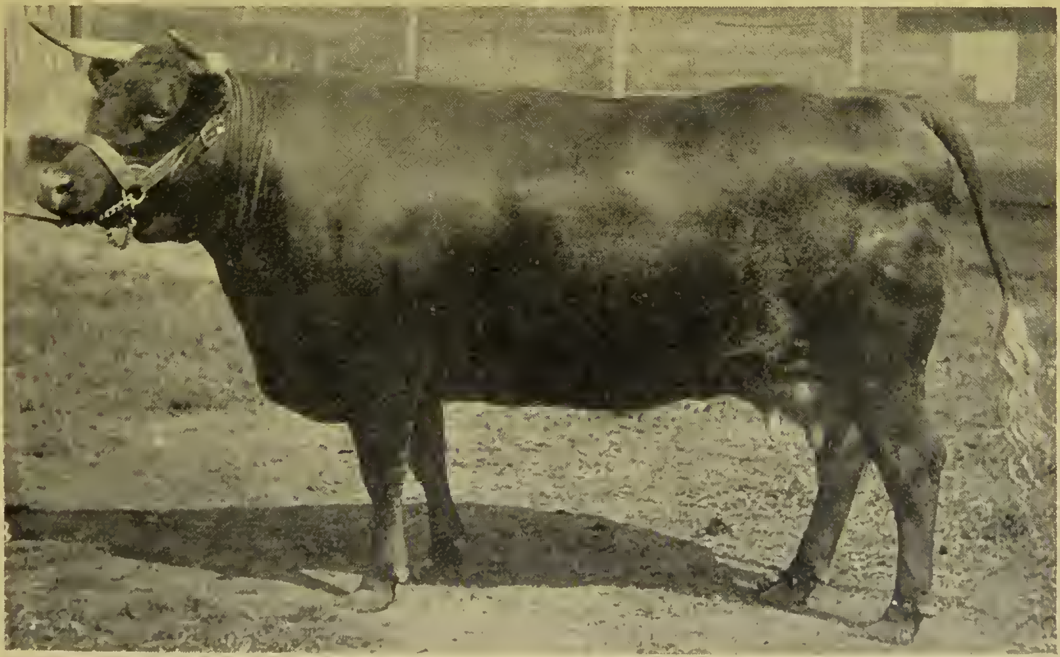


THE CHAMPION SUSSEX BULL, BIRLING RALPH

The Prize South Devon Cow. May 4th

SOUTH DEVON CATTLE

This deviation of the breed differs from those of the northern part of the county in being larger, coarser and not so darkly coloured. In recent years they have been increasingly popular for both beef production and milking purposes, and there is no doubt that there has been considerable improvement in the type of animal and in their quality. They have been in demand for export to South Africa, South America, and



Prize Sussex Cow
1st Bath and West Show, 1908.

Prize Welsh Heifer, Madryn Sally, owned by the University College of North Wales

North America, and the records of their capacity for beef production are extremely satisfactory.

SUSSEX CATTLE

This distinctively beef breed takes its name from the county in which they are especially common. They are amongst the largest of British cattle. They resemble Devon cattle, to which they are doubtless related in their ancestry.

Prize Red-poll Steer

The hair is short, the horns long, strong and more irregular than those of Devons, approximating more closely to the type of Longhorns. In colour they are a deeper red than the North Devons. A photograph of one of these Sussex cattle compared with that of a Devon shows the former to be larger and stronger but not so big in build as the Devon. The bullocks were largely used as animals of the plough, being excellently suited for the heavy soil of their county.

The steers are very popular with butchers and consumers, coming rapidly to maturity and weighing extremely well for their age. Mr. W. C. Young states that for beef production, draught purposes, hardiness, early maturity, beautiful fine-grained flesh and ability to thrive on poor fare, few breeds can equal the Sussex. These are valuable properties, and it is no wonder that the Sussex cattle are highly thought of by their owners. They have the faculty of laying on a prime quality of flesh on the most desirable parts of the body, and although they thrive on rough and somewhat poor pasture, they nevertheless well repay good feeding and care.

Prize Aberdeen Angus Bull, Everwise

The object of breeders for beef production being to produce the most profitable butchers' beef, and one which comes to early maturity without impairing the constitutional characters of fecundity, it is no wonder that the Sussex are esteemed.

WELSH BLACK CATTLE

These are usually known as South Wales Black Cattle and North Wales Black Cattle, although the two are doubtless of the same breed and closely related, differing, however, in certain points.

A Champion Aberdeen Angus Bull's Head, Wizard of Maismore

The South Wales Black cattle are somewhat like the West Highland cattle, the coat being long, but, unlike the straight coat of the Highland animal, it is curly or waved. When allowed to mature at their own time, they produce excellent cattle, but have no great capacity for early fattening.

The North Wales Black cattle are shorter in the leg, heavier in the head, thicker in the neck, having thicker, shorter and wider horns. The hair is more silky, and, though wavy, it is not curly. The most popular colour is black, though there are often patches of white. Red occurs at times. They are not so wild as those of South Wales.

They are better beef-producers than those of the northern part,

Aberdeen Angus Steer, Pan of the Burn, Junior Champion, Edinburgh and London, 1908

The Champion Aberdeen Angus Cow, Juana Erica

the back being broader. In the Midland markets the bullocks are known as Welsh Runts, and are prized for grazing purposes.

Quite recently, Black Welsh cattle have been introduced into America, where their hardiness of constitution will doubtless make them a popular breed. As they have been accustomed to depend upon grazing all the year round, living an open life with but little shelter, the breed is naturally a hardy one. Professor Wallace well remarks that had the American ranchers selected in the first place Herefords, Welsh, Galloway, or Highland cattle, and been contented to manufacture beef at a slower rate, they would have saved themselves the severe lesson that they have had to learn by the immense loss of their cattle from death. As it is, they have had to come round in the long run to the hardier types.

WHITE WELSH CATTLE

This variety is found in certain districts of North Wales. They are characterised by the white belt around them, either on the black or red

Herd of Pedigree Aberdeen Angus Cows and Calves colouring. They are large, rough animals, not good milkers, but growing to tremendous weights.

ENGLISH RED-POLLS

Red-polled cattle have been developed into a general-purpose breed of great merit by crossing good specimens of the old Norfolk horn breed of grazing-cattle with good milking-cattle of the Suffolk Dun type. Hornless, or polled, cattle appear to have existed in the county of Suffolk from time immemorial, and immense numbers of Red-polled cattle have found their way to South America, Australia, South Africa, New Zealand, Canada, and the United States. The steers mature young, being ready for market at an early stage and giving a very fine quality of meat. At about eighteen months old, if taken off grazing, they will grow until about two years, making an average increase of nearly two pounds per day. The meat commands high prices. Red-polled cattle have been largely exported to the Argentine.

Champion Galloway Cow, Royal Show, 1906

In recent years the breed has come to the front, being not only improved in quality but having also increased greatly in the number of good herds.

ABERDEEN ANGUS

This splendid and important breed probably came originally from the wild cattle of Scotland, resulting from the mixture of various different Polled and Horned breeds which, by means of careful selection, has produced the present characteristic animal, in which the absence of horns

The Champion Galloway Bull, Chancellor of Ballyboley

and the almost uniform black colour are prominent characteristics. At the present time, the Aberdeen Angus occupies amongst Scottish cattle very much the same position that the North Devon does among English breeds for quality of flesh, refinement of style, perfection of the rounded type of symmetry and, it may be added, for the excellence of its marbled

The Champion Galloway Bull, Romulus

PRIZE KERRY BULL, MELCHO

beef; yet it must not be forgotten that these qualities, like those of all British breeds, however distinct and however permanent they may be, are the result of the commingling of blood of various kinds. No single breed is pure, if we go back for a few generations. Each breed has its ups and downs in the record of its development, and it is pretty generally recognised among experts that the early years of the present century marked some of the periods of depression in the history of this Northern Polled breed, during which regression was probably more active than progression. The normal colour is black, but the russet-brown referred to in the varieties of the older breeds, and also white patches of moderate dimensions about the udder and belly, are tolerated.

Though in appearance an animal of this breed looks small, yet owing to its short legs and rounded form its weight classes it among one of the larger breeds. The absence of patchiness and the equality and levelness of flesh are proverbial. The milking qualities are low as regards quantity, the result of breeding for beef and the prevailing custom of suckling the calves, but the quality of the milk is good.

The breed has been extremely successful in recent years at the London and Birmingham Christmas Fat Shows.

The Aberdeen Angus comes to maturity very early, when compared, weight for weight, with the Galloway.

At the various live-stock shows throughout the country in 1909 there was quite a remarkable triumph for the Aberdeen Angus breed of cattle, and they showed up well, not only in the breeding classes. but in the block tests; proving again that this breed is superior for the meat-purveyors' purposes, and exhibits, on the average, more flesh to the amount of bone than any other breed.

Kerry Cow, Compton Dolly Varden

Owned by H.M. the King; the winner of many prizes, including 1st Royal, 1908.

THE GALLOWAY

This is one of the oldest, as well as one of the hardiest, of all British breeds, taking its name from the district in the south-west of Scotland. At one time, up till one hundred years ago, this was the most common breed in Scotland west of the Tweed and south of the Forth.

The Galloway cattle are black in colour, polled, and the hair, when long, exhibits a brownish tinge at the tips. There is a tendency to revert to the white colour, probably indicating their original descent from the ancient white cattle, and white patches as well as belted markings occur frequently. The head ought to be wide and short, as contrasted with that of the cross-bred animal, which is long. The legs are set farther back than in most cattle and point upwards. There is a profuse covering of silky, wavy hair. The flesh is considered as "prime Scots," the marbled beef being well distributed. The bulls usually stamp their characters upon their cross-descendants, the offspring being almost invariably black with any breed of cow, except the Shorthorn, and usually polled, even with cows of horned breeds.

Effects of Breeding. Professor Wallace has some weighty words in connection with this breed, which have a wider significance also, and which may well be quoted here. He says: "The breed did not acquire this special prepotency, as improved cattle have usually done, by close breeding on both the male and the female sides. Close breeding has been practised only within recent years, as may be gathered from their wonderful hardiness of constitution and also from their being, under natural home conditions, rather slower than most breeds in coming to maturity. Still, under forced feeding from early youth, the great wealth of constitution enables them to stand the unnatural pressure and to rank well with early maturity breeds.

“ The old breeders knew well that to attempt to improve them on the lines adopted by Shorthorn men, to increase their size and lessen the period spent in coming to maturity by close breeding, meant ruin to the constitution of the breed in the matter of withstanding the cold and inclement weather to which they are exposed under natural conditions in their native district. It is impossible to obtain excellence in regard to rapid maturity by the usual course of in-and-in breeding, and retain the hardihood necessary in mountain cattle. This country already possesses an abundance of breeds that fatten quickly, and it would be a misfortune if a breed of animals that with open-air quarters both summer and winter, after the first year is past, now produces the finest quality of beef, often on inferior food and within adverse climatic surroundings, were thoughtlessly and ignorantly sacrificed in the rush for early maturity. We have not yet seen the final results of the system of in-and-in breeding, which has been going on more or less closely for one hundred years; but the time may come when it will be necessary to go back to such breeds as the Galloway to recruit the ebbing strength of some of the greatest sufferers from the consequences of the practice. Tuberculosis, which is both prevalent and on the increase in some breeds, is one of the signs that should warn breeders of the peril of a heedless course of in-and-in breeding. The disease is almost unknown among Galloway cattle.”

If Galloway cattle be crossed with a bull of a good flesh-producing breed, either Shorthorn or a Hereford, the result is usually an excellent meat-producing animal. The beef of such crosses is of the finest quality, that from the Hereford being possibly the better of the two.

Carlisle Market is the great selling-place in the north of England for crosses of the Galloway breed, especially those with Shorthorn bulls.

BELTED GALLOWAYS

This strain of the old Scottish breeds, sometimes known as the Sheeted or White Modelled Galloways, is now extinct, their chief home during recent years having been on Tyneside. The white marking is not absolutely uniform, at times being only on one side, at other times being not more than a patch.

KERRY COW

These are often called “ poor man’s cattle,” from the fact that the breed is one that is usually found in the possession of the Irish cotter. The breed is undoubtedly an old one, and the animals are neat, active creatures with delicate limbs, somewhat small head, and with a horn which is white except for the tips, which are black. Kerry cattle are the only pure breed of Irish cattle nowadays, though formerly there were four or five breeds. They have the useful quality of producing beef

Old Gloucestershire Bull, Jock

on very ordinary pasture-land, on which they are found to fatten quickly, and give a meat of an extremely fine and good flavour, while the average milk yield may be said to be three gallons per day. In colour these animals have an orange skin with black hair, but reddish brown specimens are also met with, as are white markings. The general shape of the Kerry suggests the Jersey or the Ayrshire, though the size is less.

Old Gloucestershire Cow

Although a general-purpose animal, its build suggests a milk rather than a beef breed.

OLD GLOUCESTERSHIRE CATTLE

This old breed of cattle has only survived by the efforts of the Beaufort family, and was referred to so long ago as 1834, by Youatt, as nearly extinct and of evident Welsh origin, mingled with the Hereford. The characteristic marking was a white streak at the root of the tail extending along the back.

Authorities and References. Space does not allow of our entering into further detail in connection with the various breeds of cattle, nor is it necessary for our purposes, but we would refer our readers to the following books and writers, to whom we are indebted for much information: Professor Robert Wallace's "Farm Live-stock of Great Britain" (Oliver and Boyd); "Encyclopædia of Agriculture" (Wm. Green and Sons); the writings of James Bruce, Primrose M'Connell, B.Sc., Professor Wrightson, Professor Penberthy, Very Rev. John Gillespie, LL.D., John Hill, Professor J. Cossar Ewart, James Cameron, John Neill, A. S. Grant, T. H. Weetman, D. Young, W. W. Chapman, and to the writers of the various stud-books and herd-books of various breeds.

The photographs of the different breeds in the foregoing pages are by Mr. Parsons, Alsager, Cheshire.

CHAPTER III

BREEDS OF SHEEP FOR MUTTON PRODUCTION

LINCOLN SHEEP

The splendid breed of Lincoln sheep has an interest reaching back for a great many years, some of the modern flocks dating from 1740. It is one of the largest breeds in England, and is especially good with regard to the production of mutton, accounting for, perhaps, as heavy a weight per animal as in any other breed. The fleece, too, is extremely heavy, so that it may be regarded as a general-purpose animal.

The fact that there is distinct evidence of the purity of the breed extending through a pedigree reaching back to the date above mentioned gives great force to the argument for continuous straight-breeding of sheep.

The modern Lincoln has undoubtedly a little of the improved Leicester in its blood, but the introduction of that dates back to more than a century ago, so that the breed as at present constituted must be regarded as quite pure. For many years Lincolns have ranked second to none in respect of both mutton and wool production, not only in Great Britain, but in many foreign countries and our own colonies. The prices which are brought by Lincoln sheep to-day are the result of the capable attention which has been paid to the breed by those in whose hands they have been for many generations.

Thirty or forty years ago, when the sheep-breeders of New Zealand were buying great quantities in order to stock their lands, the Lincoln was a favourable breed for purchase, and one sale of thirteen sheep to that colony is recorded at an average price of £24 14*s*. per head. At that time a large number of New Zealand breeders came to this country and bought numerous rams from the flocks owned by Mr. Dudding and others. Since then the demand from New Zealand has been largely transferred to the Argentine, especially during the last ten to thirteen years.

One very potent factor in the popularity of the breed is the fact that wherever the Lincoln sheep have been introduced, as in New Zealand, the change of environment has been invariably followed by an improvement in both the mutton and the wool.

Lincoln Sheep in New Zealand. According to Mr. A. S. Grant, "It may be said, without giving undue preference to the breed, that the present-day position of the New Zealand mutton and lamb in the British market dates from the time when the importation of Lincoln sheep to New Zealand had had time to make its influence felt. No greater fallacy

Lincoln Longwool Rams

exists than that the high quality of the New Zealand mutton is owing to the Down breeds of sheep. This is not so, for the official statistics of New Zealand show that the white-faced breed, headed by the Lincoln, are those to which this credit must be given. The same result has been secured in the Argentine. Previous to the time when the Lincoln sheep were taken to the Argentine in any considerable number, that country's production of wool and mutton was infinitesimal as compared with the present date, and the value of the carcase there from a mutton point of view was simply *nil*.

Prize Lincoln Shearling Ewes

"During the past twenty-five years a total transformation has come

Lincoln Shearling Ewes in Full Wool

over that country, and at the present time the Argentine mutton is rapidly reaching the highest degree of excellence of the mutton imported to this country, and the position occupied by its cross-breed, both in flesh and wool, the resultant produce of the Lincoln upon the native sheep, is such as proves beyond dispute that the result of this notable transformation, so greatly to the benefit of the Argentine estanciero, is due, and due only, to the Lincoln breed."

Prize Lincoln Shearling Ram, Riby Gloucester Champion

At the present day one of the most important factors in the production of meat for the British market is to secure an animal which matures early, and this applies with equal force to both the beef and mutton animals. If the tables of statistics be read in this light with reference to the various breeds of sheep, it will be shown that the Lincoln breed has a remarkable aptitude for rapid production of high-class mutton.

Lincoln Sheep in 1909. The following paragraph from the *Live-stock Journal Almanac*, 1910, shows the present attitude to, and position of, this breed :

"Although the advance in the price of wool during the year was welcome, and gave some needed aid to the trade, the serious drop in the value of mutton considerably affected the demand for ordinary sheep, but many of the registered Lincoln rams offered for sale again commanded very high prices. By the time the flocks had entered upon the season for lambing the weather had become unfavourable, and losses were considerable in several instances, while during the spring keep was also a difficulty. The statistics of the Board of Agriculture, collected in June, showed an increase in the number of sheep in the county for the year, the total being 1,092,177, against 1,059,171 in 1908. Lincolnshire still stands second in the United Kingdom as regards its sheep stock, being exceeded only by Northumberland.

"There is a decline to be noted in the number of Lincoln sheep exported during the year. Mr. William Frankish, Secretary of the Lincoln Longwool Sheep Breeders' Association, gives us the following note of certificates issued by the Association from October 1, 1908, to September 30, 1909: Rams, 1184; ewes, 239; ram lambs, 106; ewe lambs, 43. The sheep were exported to the following countries: 669 to Buenos Ayres, 11 to Holland, 12 to Australia, 7 to Germany, 55 to Canada, 12 to the United States, 28 to North America, 16 to Spain, 28 to Russia, 616 to South America, 2 to Uruguay, and 1 to France.

"The total of all classes exported was 1566, against 2559 in 1908."

LEICESTER SHEEP

This very famous breed of British sheep, perhaps the very finest of the improved breeds, owes its position and reputation to one whose name will ever be remembered in connection with the breeding of sheep, namely, Robert Bakewell. Originally the Leicester was a large sheep, found over a considerable part of the Midland counties extending into Yorkshire, to Gloucestershire, Oxfordshire, and Leicestershire. As far as is known, the breed was a pure one, and it is interesting to students of biology and others to point out that the improvements which Bakewell and his followers effected upon the breed were due, not to crossing with other varieties, but entirely by the selection of advantageous variations in the breed themselves. His attention was directed to producing an animal of more perfect symmetry, one which matured early and fattened rapidly and well. In other words, he developed the commercial part of the animal, especially in the domain of the meat, at the expense of its size, reducing the bone and increasing the fat. The latter was a point of greater importance in his time than to-day.

Professor Wrightson thus describes Bakewell's system: "It was Bakewell's habit to select females possessed of the most perfect symmetry combined with the greatest aptitude to fatten, and these qualities he found to his hand in the smaller class of sheep carrying a comparatively light fleece. Having formed his stock, he chose his breeding animals with the greatest care as regards both ewes and rams, and was not afraid of breeding from near relationships as long as he could produce progeny possessing the characteristics he wished to obtain. By careful selection and clear and defined conception of the object he had in view he succeeded in a few years in producing an improved race. He also adopted the practice of letting his rams rather than selling them, and by this

Prize Leicester Ewes and Lambs

A Typical Leicester Ram's Head

Pen of Prize Leicester Shearling Ewes

means secured an extraordinary choice of sires and was able to watch the result of their use, and if advisable retain them for his own service."

To Bakewell also belongs the honour of establishing the first breed society, namely, the Dishley Society.

The animal which was the result of this system is thus described by the same authority: "The superiority of the new Leicester lies in its wonderful propensity to fatten and its early maturity. The carcase was somewhat reduced in size in comparison with the original breed, and in the early period of improvement the fleece was neglected."

Points of Leicester Sheep. "Among other attractions were its perfect symmetry, compactness of form and uniformity of type. They arrived at a weight of 24 to 36 pounds per quarter at one and a half years old. Next, as to general appearance and points, the New Leicester as evolved by Bakewell is a white-faced, hornless breed with black lips and nostrils, fine, well-shaped ears, and a top-knot of wool extending over the crown. The head is carried rather horizontally, and is wedge-shaped or tapering towards the muzzle. It is attached to a thick and short neck, which passes insensibly into the shoulders and breast, and the body is of enormous girth behind the shoulders. The carcase is compact, oval-shaped and well carried out to the tail, of great depth and well furnished with mutton both in the fore- and hind-quarters. The breast stands prominently forward from between the fore-legs, giving great squareness of form, and the belly-line from brisket to thighs is straight and near the ground. The back is perfectly straight and level from scrag to set-on of tail. The ribs are well sprung, and both shoulders and legs are well developed. The width of carcase is seen in the great space between the fore-legs caused by the broad breast or sternum, and also in the 'twist' or junction of the thighs. The entire carcase is elliptical in form when viewed from above, and is well covered with flesh, especially over the back, ribs, and both fore- and hind-quarters. Neither ribs nor back-bone can be felt on handling, and the flesh along the back and ribs is extremely thick. The fleece shows a rather fine curl over the whole body, but is liable to be deficient under the belly in ewes. The shanks, like the face, are white."

Changes in Fashion and Taste. The Leicester sheep, as we see it to-day, conforms practically to this description,. but there is no doubt, whatever the cause may be, that the form of the sheep has become more robust than was the case thirty or forty years ago. As showing the caprice of fashion or taste, and the way that a change in these may alter the popularity or value of a good type, it may be mentioned that the fault of the Leicester sheep to-day is regarded as being the tendency of the animal to produce fat. In former times that was one of its chief advantages. But the modern demand is rather towards lean meat than fat, or, at any rate, to meat considerably leaner than our forefathers prized. For this reason Southdown mutton is held in greater esteem than Leicester, and it would be somewhat interesting to see what effect this change in public taste will have in the future position of the Leicester breed. Should the test remain as it is now, probably it will lose some of its favour, but whether this be so or not, the immense value of the Leicester sheep to the meat industry can never be over-estimated, because almost every modern breed of sheep has been directly or indirectly affected by crossings with the Leicester. Thus, Professor Wrightson says that no one can deny that the Leicester breed and the Border Leicester are closely related; that the improved Lincoln was produced by Leicester crosses with the old Lincoln; that the Teeswater breed derived great advantages from Leicester crosses both in Bakewell's time and subsequently; that the Cotswold breeders "repaired to Leicestershire for lambs for improving their sheep in the early part of the last century; that the Oxford breed through the Cotswold have received a proportion of Leicester blood, the same being true of the Shropshire sheep; that the Devons, Romney Marsh, and Wensleydales all benefited by Leicester blood; and finally, that the Leicester and Down cross-bred sheep have always been much admired and general favourites." There was a time when sheep-breeders devoted practically their whole attention to pure-bred Leicesters and Southdowns, and if it be true, as Professor Wrightson says, that if one takes away the Border Leicester from the breed it leaves so little, it is nevertheless also true, as he says, that it leaves a history full of interest to the sheep-breeder, and a most triumphant record in which not the least important event is the rise of the Border Leicester.

Prize Leicester Ram

Leicesters in 1909. Mr. W. A. Brown sums up the present position of the breed thus (*Live-stock Journal Almanac*, 1910):

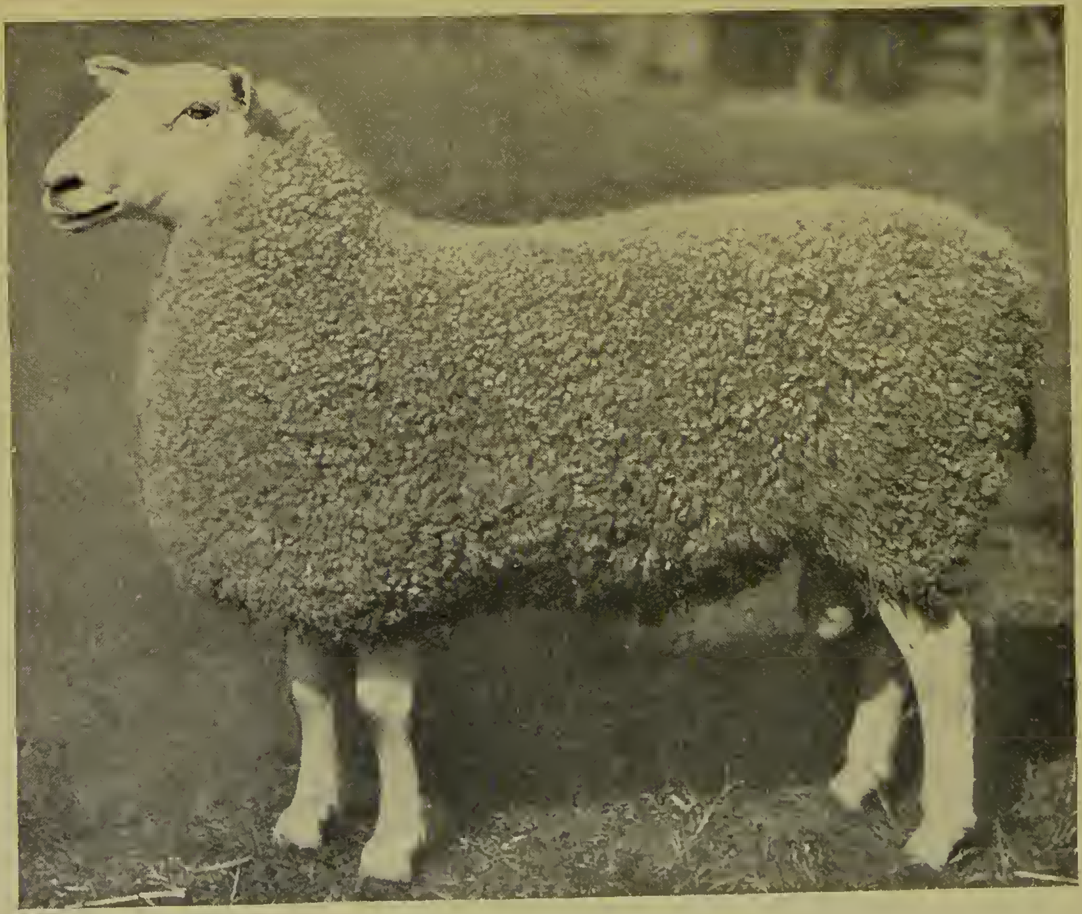
"The past year has shown a steady and progressive movement amongst the breeders of Leicester sheep. At all our chief shows improvement in quality has been most marked.

"The demand for rams for exportation is an improvement upon last year, several well-known breeders having disposed of stud sheep to our kindred beyond the seas. Some rams have been sent into Wales this year for crossing purposes. Advantage would ultimately accrue to all breeds and breeders if greater care were exercised in the retention of male sheep. We have seen rams kept and sold for stud work that should have gone to the block in the spring of the year. It is better to keep ten good rams than a bunch of twenty moderate ones."

A writer recently in the *Otago Witness*, speaking of the Leicester-Merino cross, said: "I have enjoyed a wonderful treat in looking over some good-sized samples of cross-bred wool grown at Bolinda Vale, West Victoria, belonging to Sir Rupert Clarke. For cross-bred wool it is the champion clip of the world. Where climate and pasturage is suited for these sheep, the result of the cross is always satisfactory, both from a wool and mutton standpoint."

BORDER-LEICESTER SHEEP

This breed, to which we naturally next turn our attention, is the common sheep of the low country of Scotland and the north of England,



THE CHAMPION BORDER LEICESTER, GLADIATOR, AT THE ROYAL, 1908 AND 1909

Prize Border Leicester Ewe

in which part of Great Britain it stands to-day without a rival as the general-purpose breed. There may be other breeds to which it might have to yield the palm as regards the very highest quality of mutton or the best class of wool, but there is no breed which can compare with it as an improver of all other breeds in both these objects. Thus Mr. A. S. Grant says: " Crossed with the Cheviot, for example, the Border-Leicester produces the valuable half-bred which it has been said pays more rent in the arable parts of Scotland and Northumberland than any other variety of sheep. Put to the Blackface ewe, the Border-Leicester ram gives the highly valued cross (sometimes also called Grey-faced) sheep so popular in the midland and northern districts of Scotland, and probably the best mutton sheep in Great Britain. It would not be easy to estimate the financial value that has attended the introduction of the Leicester (now called Border-Leicester) breed into Scotland and the northern districts of England. Certainly hundreds of thousands of pounds would not be too big a sum to name; indeed, agriculture in the lowlands could hardly have been developed as it has been without the Border-Leicester. The breed, it must be remembered, was brought north just at the time when the pioneers of border farming were transforming barren wastes into verdant pastures or corn-growing lands. Turnip husbandry had also just been developed in the district. The

Leicester (with the stock bred from it) was exactly adapted to the new system, and gained in popularity day by day. From the borders it rapidly spread north, until now Border-Leicesters are to be found all over the low grounds of Scotland to as far north as Caithness. South of the border they occupy land as far down the kingdom as Yorkshire, although the extreme northern counties, Northumberland, Durham and, in a lesser degree, Cumberland, are still their principal centres in England. Their great aptitude to fatten and their early maturing properties make them all but indispensable for crossing purposes."

Points of Border-Leicesters. In judging this sheep attention is directed in the ram to the fleshy frame, good-class wool and elegant symmetry. In the female the same points claim attention, and especially is great stress laid upon the character of the head, which ought to be pure white and well carried above the line of the back, as seen in our illustrations.

The ears are well set up, and the face arches towards the muzzle, the jaws being deep and the nostrils wide, whilst in recent years the nose is preferably black.

Sheep with black spots on the ears or face are not objected to, though most breeders would reject them for breeding purposes. The worst fault is a blueness of the skin. The neck is strong, slightly arched, with a prominent neck-vein below ; the back level and straight ; the loins wide and firm ; the ribs round the paunch deep. Judges lay great stress upon the movements of the animal, style being of great importance. The legs should be clean. One of the most famous flocks is that of Lord Polwarth, of Mertoun, which was founded in 1802, and which has been bred according to Bakewell's system, no sheep having been introduced from outside for more than forty years.

Recent Winners. At the recent Royal Show the Rt. Hon. A. J. Balfour won the first prize and challenge cup for two shear-rams, and first for shearlings ; and these same sheep won the President's medal and that of the Border-Leicester Society at the Highland and Agricultural Show.

THE SCOTCH BLACKFACE

This highly bred sheep is smaller and hardier than the Cheviot, thriving better on coarse pasture and in the land of moor-heather. The face and legs are black or mottled, smooth and glossy. The nose is broad, the nostrils wide and black. The striking feature of the breed, as far as appearance is concerned, is the immense size of the horns in the ram. These take one or two spiral turns in a forward direction, according to the age of the animal, sometimes to such an extent that the point of the horn may have to be cut off in order to allow the animal to feed off the ground. The Blackface is a wild, active sheep eminently suited to its Highland habitat. The sheep has improved from the point of view of early maturity during the past generation or so and is more compact and better ribbed than it was forty years ago, and it is just possible that this earlier maturing has carried with it a diminution in the hardiness

Group of Prize Shropshire Rams

of the constitution. Mr. James Cameron says that in the whole range of mutton there is nothing finer than a cut from a hill-fed August or September black-faced wether, and that every carcase should have a keeping of ten days hanging in a cool, fly-proof larder.

Blackface Sheep in 1909. Writing on this famous breed in the *Scottish Farmer Album,* 1910, Mr. Ralph Fleesh makes the following comments on the present position and the breed in general:

"The Blackface sheep-breeders deserve praise. They have worked hard to keep their sheep in the front rank of agricultural products, and they have succeeded. From many quarters have come pessimistic growls, but these only told of disappointed and soured souls. Incapacity is the parent of cynicism. Ofttimes has it been declared that we have seen the golden age of the Blackfaces, and that their popularity was on the wane. But as often have we witnessed the falsification of such prophecies and assertions, for the wings of progress seem to beat as strongly as ever.

Prize Shropshire Ewes from the noted Flock of Mr. Thomas Paston, Weston Hall, Crewe, Cheshire

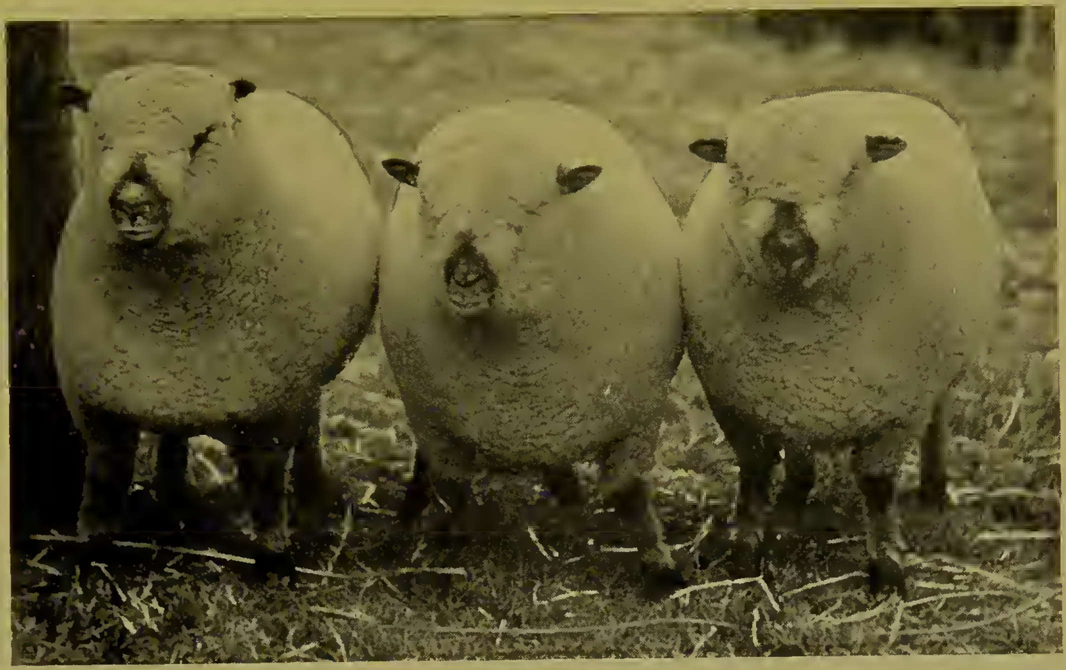
The Blackface sheep is so distinctly Scots—has such a permanent place in the affections of Scotsmen—that he may now be regarded as a commercial barometer. When he falls in esteem and price, the nation may be said to be going badly. And that the paths of trade—not one particularly, but all trades—have been rather rough and uphillish within the last few years most people know. It has, indeed, been a long season of gloom. But through it all there has been in the Blackface sheep trade a spirit of hope. Despair has no place in the bosom of the Blackface breeder. He may frown occasionally, and even say something not exactly complimentary to the ways of the world; but his energy and enterprise, his unbounded faith in his calling, make all associated with him feel that he fears not the morrow. This, after all, is the truest rendering of the gospel of success.

A Typical Shropshire Ram's Head

"**At the Shows.** As a result of the Blackface breeders' devotion to their business, their zeal and unstinted outlays, the interest evinced in shows during the year, despite the ominous prospect of a falling market, has been as keen as ever. The number of exhibits at the majority of shows continues to increase; the exhibits reveal a skill in breeding and a care in rearing distinctly superior to the efforts of past days; and the ideal and all-round qualities represented in the pens assert an advance that is highly creditable to all concerned. Were progress in all branches of industry similarly evidenced, we should not have had bad times. In the show realm we notice that new breeders come in and old breeders go out. This teaches a lesson. The lesson is—Don't honour the past too much; old lines deserve respect, but not unreasonable homage; the present is the best, since it has something new—if we can only find it. Young, fresh minds coming into the sheep world note this. With no ruts to retard their feet, and no hedges to limit their vision, they discover new laws, and very often find gold where none was found before. Every brain is meant to be a creator, and a hidden world waits every pair of human eyes. With this faith the young sheep-breeder works, and works to win. But there are, on the other hand, men in the Blackface world who will never be old. Time has no terrors for them. They are juvenile, alert, quick to seize an opportunity and pluck the virgin fruit of Nature's youngest vines. Such frisky veterans constitute the backbone of the trade. They teach by their example, and provide healthy exercises in humility for their younger brethren, by supplying generous doses of defeat."

SHROPSHIRE SHEEP

The Shropshire sheep of the present day is a descendant from the native small breed especially, which has been known in that county for centuries, and its present uniform type and character have resulted from careful selection by the agriculturists of the Midlands, who have devoted attention to the breeding of Shropshires, particularly since the beginning of the nineteenth century. Shropshires are found all over the world; in fact, they may claim to be a most cosmopolitan breed. No less than four thousand pedigreed Shropshires were exported during 1906 and 1907, their destinations including—in addition to all the ordinary countries which are usually associated in the mind with that purpose—such out-of-the-way places as Japan, Finland, Hungary, Chili, Peru, and Uruguay. The very fact that the Shropshires have been able to establish themselves in such a wide connection in the export trade in this country is evidence of their great capacity for adapting themselves to their surroundings. They seem to flourish in many varied climates, and are distinctly advantageous in crossing with native breeds of sheep in other lands, with the gratifying result of the production of fine quality of both mutton and wool.



Champion Shropshire Ewes

Points of Shropshires. The characteristics are thus described by Mr. T. A. Buttar: "The ram has a bold masculine appearance, with plenty of strength and character. The head should be wide over the top between the ears and between the eyes, and strong without being big and coarse;

the nose strong and wrinkled ; the eyes lively, large and prominent ; the ears medium in size and not dropping, but should be well set up. The face, ears, and legs should be of a nice mellow, black colour. The head is completely covered over the top and round the eyes with fine white wool—black or grey wool being considered a bad fault. The neck is thick and masculine, well arched, the chest full, wide and deep. The body has a thick-set appearance, being as square and deep as possible, supported by short straight legs set wide apart. The back is straight from neck to tail, wide and well covered with firm muscle. The hind leg, or gigot, is especially well developed in Shropshires, this being a point of great value to the meat-purveyor. The points of the ewe are similar, with the exception that the head and neck are finer and the character as feminine as that of the ram is masculine. The principal points in favour of the breed are the great fecundity, the average being 175 lambs per 100 ewes ; and their early maturity, due to their natural possession of much lean flesh ; this quality specially recommending the breed to the trade in fat lambs at home and to those engaged in the frozen meat trade abroad. The fine thick appearance of the carcase when hung up is due to the extra development of the gigot. The best prices are given for Shropshire mutton in both home and foreign markets. As the result of inheritance and selection Shropshires retain a great hardiness of constitution, being capable of standing considerable extremes of heat and cold with an adaptability to various soils and climates. Provided only that the management is fairly good, the breed will thrive as well on a heavy soil as a light one and in a wet district as well as in a dry one, which accounts for its distribution all over the world. Moreover, Shropshires are not voracious eaters, and for this reason can be carried with a larger number to the acre than many others. In a word, the Shropshire sheep, as the result of their combination of the most valuable points both from the aspect of the meat-producer and the wool-grower, have attained a splendid position in the sheep industry everywhere, being the most desirable general-purpose animal."

Crossing with Shropshires. " Their characteristics, too, are reproduced with great faithfulness in the crosses bred from them. For this purpose the Shropshire ram is easily the best. Cross-bred rams from ewes of the Border-Leicester, Dorset, Lincoln and other breeds and half-breeds produce lambs which come very early to maturity and mutton with a large proportion of lean meat of good quality. Shropshires are practically in good condition for the meat market at any time when required, a most valuable character. It is therefore no wonder that this breed forms almost the entire composition of the immense frozen Canterbury lamb industry in New Zealand."

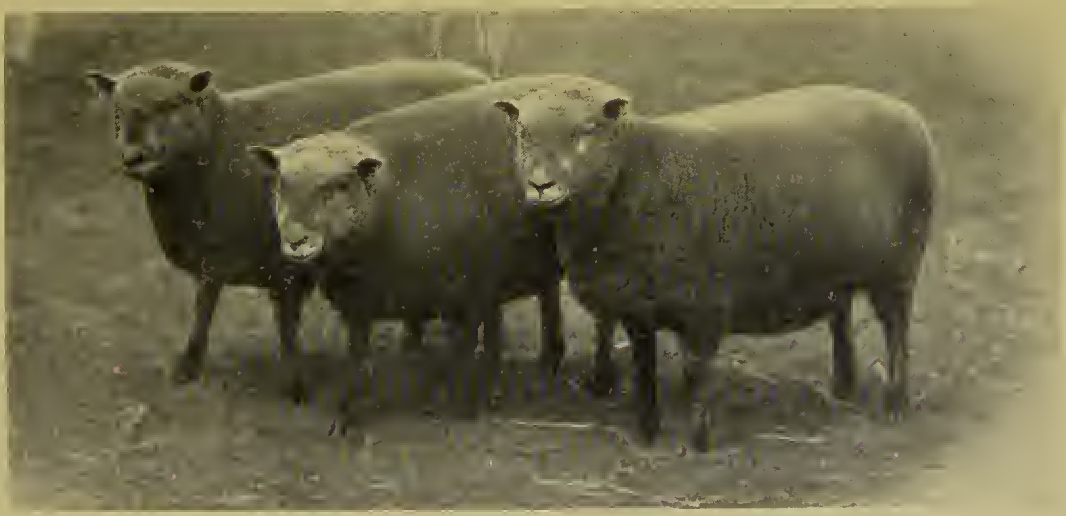
The following table shows the numbers of this breed exported to various countries during recent years :

Comparison of Recent Exports

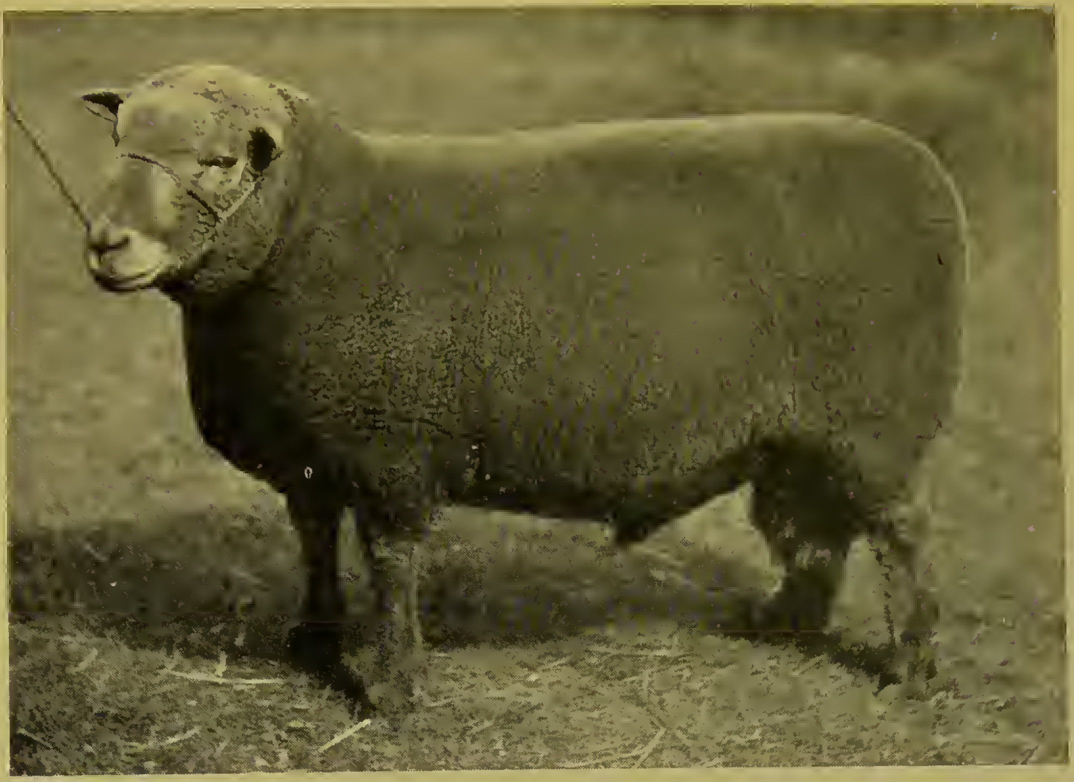
	1909	1908	1907	1906	1905	1904	1903	1902	1901	1900	1899
North America (United States, Canada, and Newfoundland)	1352	1774	1427	1057	253	217	65	424	364	481	677
South America (Buenos Ayres, Uruguay, Monte Video, Chili, Peru, Brazil) . . .	115	205	569	657	497	275	288	48	104	205	282
Australia, Tasmania, and New Zealand	3	11	212	82	153	66	331	132	228	60	41
South Africa, Algiers, Algoa Bay, &c.	9	21	45	52	54	27	46	5	29	—	76
Russia, Germany, France, Spain, Denmark, Sweden, Hungary, Jamaica, Finland, Greece, Portugal, &c. . .	122	35	61	54	75	118	58	84	265	118	10
Totals . .	1601	2046	2314	1902	1032	703	788	693	990	864	1086

SOUTHDOWN SHEEP

This popular breed has been a native sheep of the Sussex hills or South Downs for centuries. The hills which go by this name enter Hampshire and terminate at Beachy Head, the North Downs, on the other hand, running through Surrey and Kent to the Dover cliffs. The breed has been immensely developed and improved with careful artificial selection, until we see an animal which is to-day described as one which "for perfect utility of form has no rival, neither can he be excelled in finely grained quality and original colour of his mutton, which commands one penny per pound higher price than any other medium breed." The breed has been a great favourite with many noted breeders and exhibitors, including royalty and many of the aristocracy.



Champion Southdown Ewes



Champion Southdown Two-shear Ram

Professor Wrightson says that the sheep are naturally adapted to their native haunts, where they are most successfully preserved. If they be removed to deeper soils they are liable to become darker in feature and larger in frame, the light-faced, compact carcase of the breed being best seen on the Sussex Downs. There are no horns on the head, which is small. The lips are black, the ears short, rounded and pricked, but not showing so prominently above the wool as in the Hampshires. The jaw is clean, and the head has been compared to that of a fallow deer. The straight neck is short and masculine; there is great girth behind the shoulders; the brisket is wide and flat; the ribs spring horizontally from the backbone; the loins are ample, the hips broad, the quarters good.

The general conformity is that of a square or rather oval shape, and the animal gives one the appearance of a highly bred one. The flesh is very firm on the back and abounds in lean meat.

Southdowns do not give the same weight of mutton per carcase as Hampshires, but what they lack in quantity they make up in quality.

Southdown Sheep in 1909. Mr. Jonas M. Webb thus writes on the breed (*Live-stock Journal* for 1910):

"The year 1909 will probably be remembered by many concerned in the rearing and feeding of ordinary sheep as a disastrous one; both in England and Scotland many sheep were sold out in the spring at the same price that they had cost in the previous year, leaving nothing for their keep. But prices of those of the larger breeds suffered most, Southdowns weighing much less making in the markets as much per head as

Prize Kent Shearling Ram

the larger sheep. This caused a good demand in the autumn for Southdown rams for crossing purposes. Breeders also suffered in a degree during the summer and autumn months, for although keep was plentiful

Prize Kerry Hill Ram, Gweryngoe Ensign

the absence of any continuous sunshine and also the constant rains affected the quality of roots and green crops. The late harvest extended into the month of October, even in the south of England, and the heavy fall in the price of corn caused a scarcity of money when sales were in progress."

KENT AND ROMNEY MARSH SHEEP

The district from which this breed takes its name has been famous for its sheep as long as there is any account of its fame at all. The curious fact of the breed is that, according to all sheep-breeders, the pure-bred Romney Marsh sheep thrive better in the severe climatic conditions than any cross-bred sheep, which may be the result of the introduction of other blood. The breed has widely gained in popularity amongst those sheep exported to New Zealand and the Argentine, doubtless one of the reasons being that Romney Marsh sheep require but very little attention. Like Highland cattle, they have been evolved under conditions which have tended to the elimination of the unfit amongst them, and as they have not been sustained by any artificial help in the way of protection or feeding, the result has been the production of a constitution remarkably hardy. They differ from most other breeds also in a curious characteristic, and one which is of great value to the grazier, namely, that instead of herding together in a mob they spread out over a wide area when feeding, so that each sheep feeds almost by itself. In this way they obtain much greater benefit from the grazing and keep much freer from disease, and in addition do less harm to the land. Since the introduction of the frozen mutton trade, the value of the Romney Marsh sheep has gone up immensely, because it produces a carcase of excellent quality and with little fat, and in more favourable climatic conditions matures earlier than in its native haunt, all of these being qualities which make for commercial value. In all these points the Romney Marsh sheep occupy an excellent position. In 1909 this breed was better represented in both number and quality at the Royal Show than, perhaps, ever before, there being nearly eighty entries.

KERRY HILL SHEEP

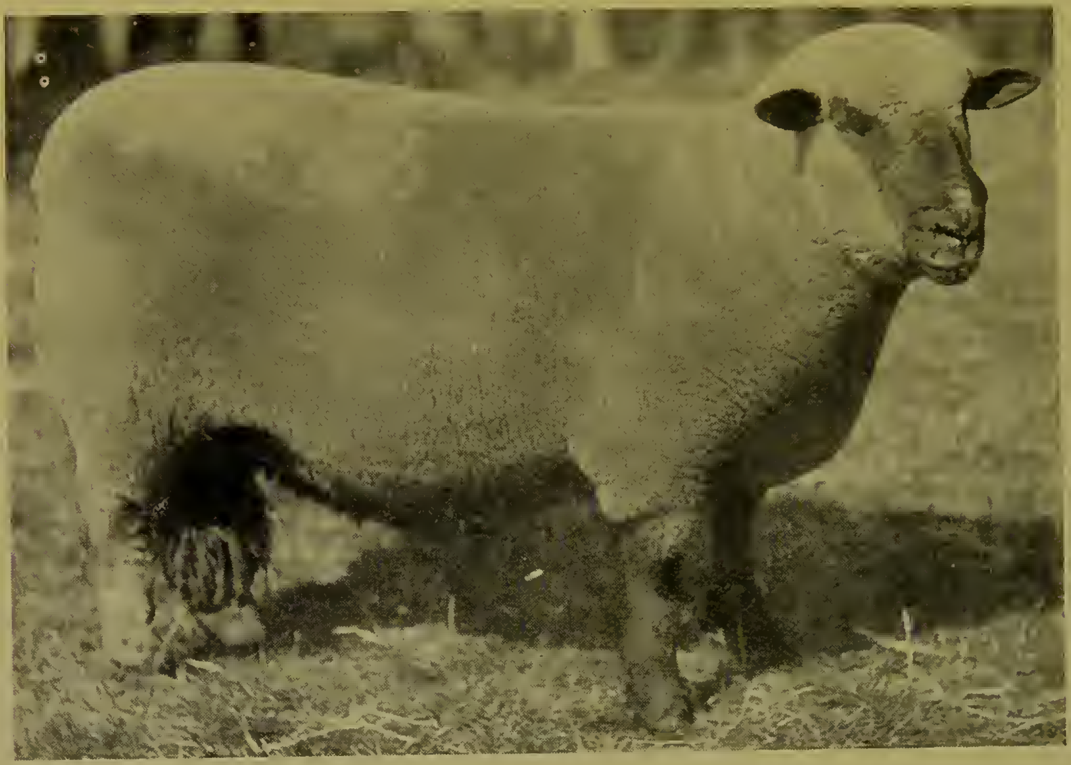
This is another breed which takes its name from the district in which it has been for generations, namely, on the Kerry Hills of Montgomeryshire, Radnorshire, and Shropshire. It is another breed, too, which owes its strength of constitution and its capacity for adapting itself to surroundings to its natural habitat in the early part of its history. None but the strong amongst the flock could have had a chance of survival in the days when they roamed unattended for great lengths of time over the unenclosed hills. These factors resulted in the evolution of an animal with a preponderance of lean mutton, and the original type has been much improved in the direction of securing greater uniformity of colour and symmetry. This has been done, not by crossing with other breeds, which was found to be a mistake, but simply by selecting the best rams and ewes to breed from, and the result has been that the breed has thus considerably extended its area. Mr. G. MacQueen says as follows :

"Two crops of lambs are generally taken (sometimes three), then the ewes are sold and readily purchased by English farmers who cater for the fat lamb market, the excellent nursing quality of the ewes rendering them particularly suitable for that purpose. On the hills the ewes seldom raise more than one lamb each, but when taken to more fertile pastures the produce is often at the rate of one and a half lambs for each ewe. And there is a minimum of trouble at lambing time—they require no sheds for shelter, they lamb out in the open fields, and the lambs get up quickly and begin the battle of life without any help from man. The wethers are generally sold after being shorn, say, at fifteen months old ; from the best farms they are then fit for the butcher ; from the higher farms they are sold as stores, and are always in demand. The breeding of lambs is, of course, a special department of the business and undertaken by the few who have acquired a high standard of quality in the flock, who have got farms suited for the business, and who have the necessary skill and can devote the time, labour, and capital that are requisite to ensure success."

Oxford Down Shearling Ram Champion at the Oxfordshire Show, 1909

The Breed's Hardy Constitution. "The principal attributes of the breed which commend it to the hill farmer, as well as to the rich grazier, are the hardy constitution which enables them to weather all storms and pick up a living where other sheep would starve, from the day of their birth onwards ; the good nursing capabilities of the ewes ; the capability of producing early fat lambs when mated with the larger English rams; the handy, desirable size of the fat sheep and excellent quality of the mutton; and the fine texture of the wool, which is far superior to Welsh, Lonk or Blackfaced wool."

This is really a Montgomeryshire breed, being one of the most important of recent Welsh breeds, though not by any means confined to the Principality, as it is found in most of the counties bordering upon Wales. "The chief characteristics of the breed, at the present time, are speckled or mottled face and legs (black and white, not too black), compact body, a clear pink skin, with a close, tight fleece of wool" (Prof. D. D. Williams). The wethers are killed at a year old, giving an average live-weight of from 65 to 85 lb. per carcase, according to the district from which the sheep come.



Prize Hampshire Down, Two-shear Ram

OXFORD DOWN SHEEP

This is one of the most recent of British breeds, and is the result of a crossing between the two distinct breeds of Cotswolds and improved Hampshire Downs. Since both the original parents' stocks were likewise cross-bred, the Oxford Downs must be regarded as a breed composed of many strains. As seen to-day, the characters of the Oxford Down sheep are much more uniform than they were twenty or thirty years ago. They somewhat resemble the Shropshire, but in the Oxford Down a side view of the head shows that it is less coarse in outline. The ears are longer as well as the face, the Shropshire, on the other hand, having shorter ears and a compact covering of wool without the forelock of the

Oxford. The general shape is compact and heavy, as befits a breed of heavy flesh. This is a general-purpose animal of good quality with regard to both mutton and wool. The export trade in 1909 has been good, and some large consignments have been sent to other countries.

HAMPSHIRE DOWN SHEEP

This breed of sheep, which is now established as a class, was well known before 1857, and the changes in type which have led to the title of improved Hampshire Downs began before that time. Ancestors of the breed on the maternal side were the Wiltshire Crook and the Berkshire Knot, neither of which breeds now exists pure. But though the Hampshire breed is related to many others, it is nowadays of a very uniform type.

The head is bold and black, or dark brown, covered with white wool between the ears, over the forehead and on the cheeks. The ears fall outwards and are long and black, or of the same colour as the face. There are no folds of skin underneath the jaws such as occur in many of the Shropshire sheep. The neck is masculine, the scrag wide, the shoulders well laid back, the girth large, the breast deep, the ribs well sprung, the back well covered with firm flesh, the loins wide and the carcase well carried out to the tail, which is set on in line with the back. The legs are well fleshed and the twist low. The breed comes very early to maturity, lambs weighing twenty pounds per quarter being on sale by the middle of July. The Hampshire breed forms a considerable part of the export trade to the Argentine and other countries. The rams are in great demand for growing purposes for the supply of fat lambs.

Hampshire Downs in 1909. " A favourable lambing season was experienced in the Hampshire Down flocks, the lambs being strong and healthy, while the losses of ewes were generally small. In some cases the results were not so good, and there were several references to the comparative scarcity of twins. Although the root-crop was short, the sheep had been helped by an open and mild winter, so that the food question was not one of great difficulty, but purchased feeding-stuffs were dear. The chief drawback to the trade was the low price of mutton. Wool values improved, but sheep for feeding purposes were in less demand, and rates were considerably lower. This experience was not peculiar to any breed but was common to all. Moreover, the late harvest and damaged state of the corn crops delayed threshing, so that at the time when the autumn fairs were being conducted money was scarce. The sales of registered rams did not suffer much ; in fact, while the best did not realise the remarkable prices of 1908, they were steady, and the foreign demand was also exceptionally good, over nine hundred export certificates having been granted during the year.

" As rates for wool have advanced, it is hoped that the demand for mutton will improve, for people must return to the choice quality of

Prize Cotswold Ram

the home-produced article. The inferiority of imported mutton has temporarily lessened the demand, but when the change has been made the former conditions are expected to be restored. The returns of the Board of Agriculture in June showed an increase in the number of sheep throughout the country, and Hampshire and Wiltshire contributed their share to the advance. In the former county the number was 368,500 as compared with 351,897, and in the latter 491,363 against 476,626, an increase for the two of over 31,000." (*Live-stock Journal Almanac,* 1910.)

WENSLEYDALE SHEEP

This breed is found chiefly in Yorkshire, Durham, and Lancashire, the centre of the breed being in the district from which they take their name. They are striking animals on account of their size, this being apparently the object aimed at by the breeders, as well as early maturity. Some of the old records point to sheep of immense size amongst them, but as time went on it was recognised that size alone was not everything and that quality began to be more appreciated. The result was that other breeds were crossed with the original Wensleydales.

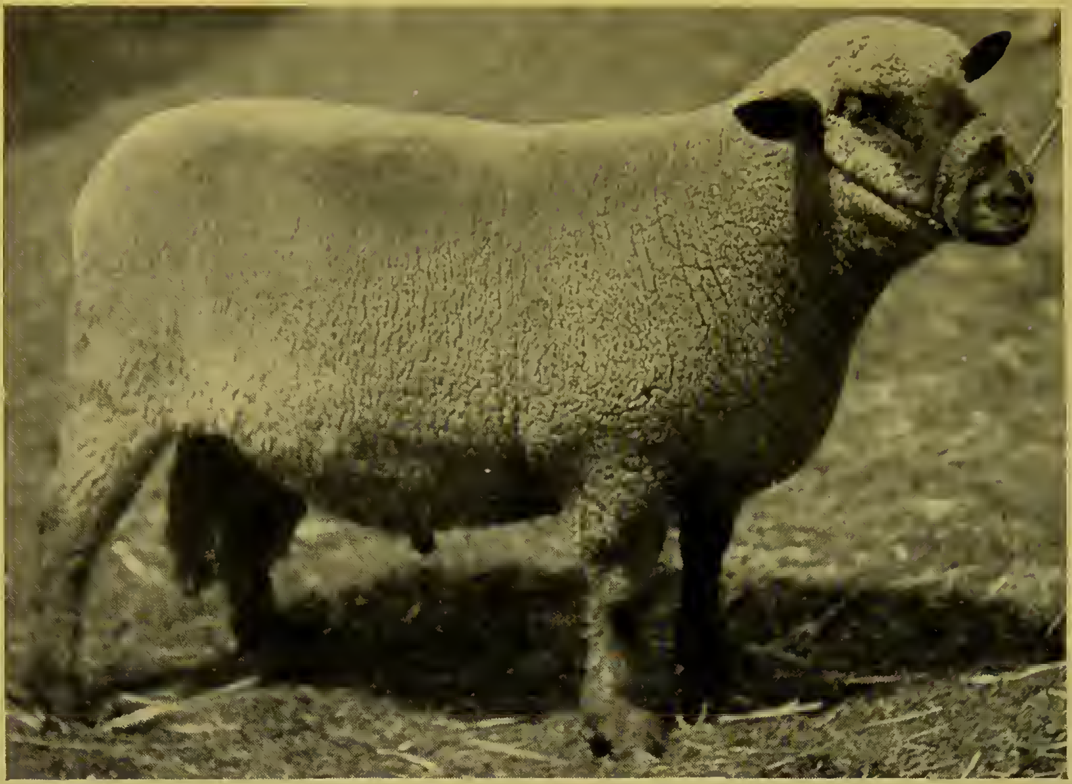
Mr. W. Parlour describes the Wensleydale sheep as comparing favourably in appearance with any other breed. "Its big size, gay carriage, sturdy look and long, bright, curling wool mark it for distinction. Its head, broad and bold-looking, is hornless; its ears are big, blue and

Prize Dorset Horn Ram

unspotted, and it has a tuft of wool on the forehead. It has a strong neck, a deep, wide chest, a broad, level back and symmetrical proportions. It must stand well on strong, straight legs, more or less woolly, and it is well covered with wool underneath. A distinctive feature is its blue face; the skin is indeed often blue, not only on the face where it can be seen, but over the whole body. The breed is hardy and prolific, produces high-class wool and a large proportion of lean mutton, and is greatly in demand for crossing purposes."

Wensleydales have thus been bred in high-lying districts near the moorlands, and being very seldom brought in for shelter, have developed, as we have seen in the case of other mountain breeds, a hardiness of constitution which is a valuable characteristic. Many of the ewes rear three lambs each. Although the wool is a very valuable part of this sheep, being of a very high standard, the animals are nevertheless full of lean mutton and are popular with the butcher. Though not specially bred for early maturity, like many other breeds of sheep they are of great value for crossing purposes.

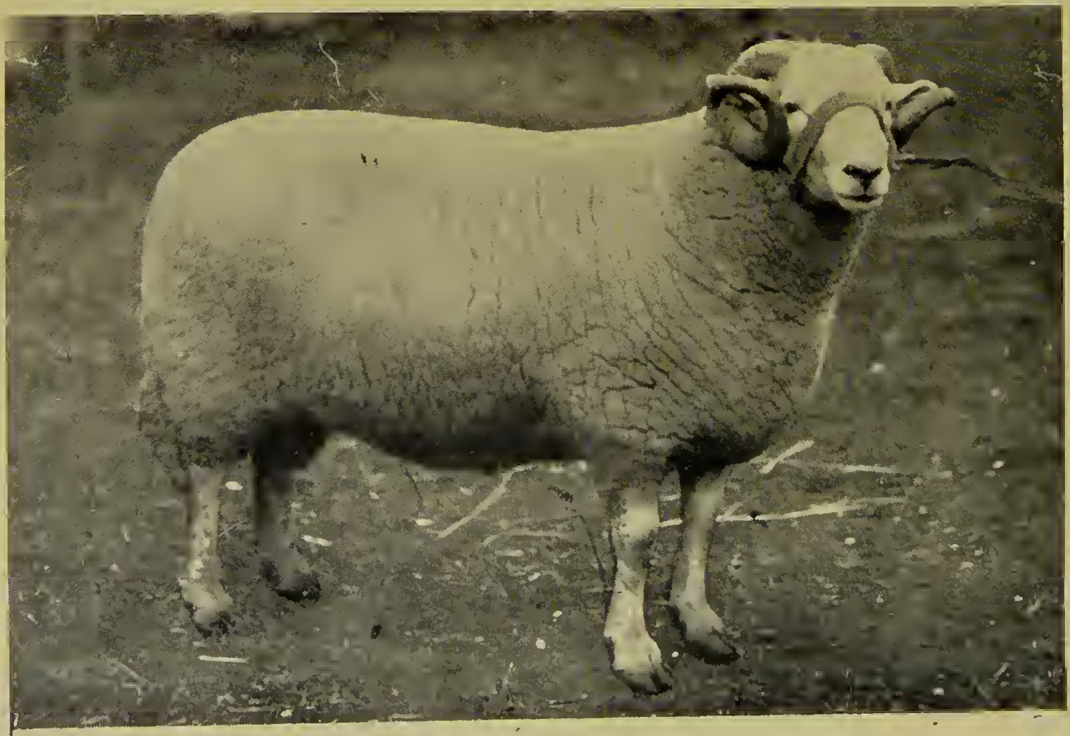
There does not appear to have been any great export trade to other countries so far, although in the case of those which have been introduced in countries such as New Zealand they have invariably done well. Owing to their capacity for yielding a good supply of high-class mutton, as well as wool, one would imagine that the Wensleydale sheep, especially in



Prize Dorset Down Ram

view of their value in cross-breeding, might have a greater demand in the future than is the case just now.

Wensleydale Sheep in 1909. Referring to this breed, Mr. J. O. Trotter remarks (*Live-stock Journal*, 1910): "It is a good many years since such



Prize Welsh Ram, Twym

a notable reduction in the price of mutton has taken place as in 1909. The decrease in prices of wool and mutton has resulted in a fall in the value of the various British breeds. Some of these have suffered more than others, short-wool sheep having held their own better than the long-wools. Wensleydale sheep are quite as much in request for crossing purposes as they ever were, but at reduced prices. This cannot be a matter of surprise when the serious drop in the price of lambs for feeding purposes is taken into account, the prosperity of the breeder being bound up in the prosperity of the feeder."

Cotswold Sheep. This breed is found especially in the county of Gloucestershire, taking its name from the hills of that district; in fact, the word Cotswold signifies a sheep-fold and a naked hill.

Pen of Dorset Down Ewes, Prize-winners

The modern breed, which has been improved considerably, is as pure as most others, since it has been developed along the lines of selection in its own family. It is a heavy, large sheep, hornless, with white face and a flowing forelock over the forehead, and a long, erect neck. The breed is not found very extensively beyond its own district, though it is of much use for crossing purposes, producing with the Hampshire sheep, as we have seen elsewhere, the improved Oxford sheep.

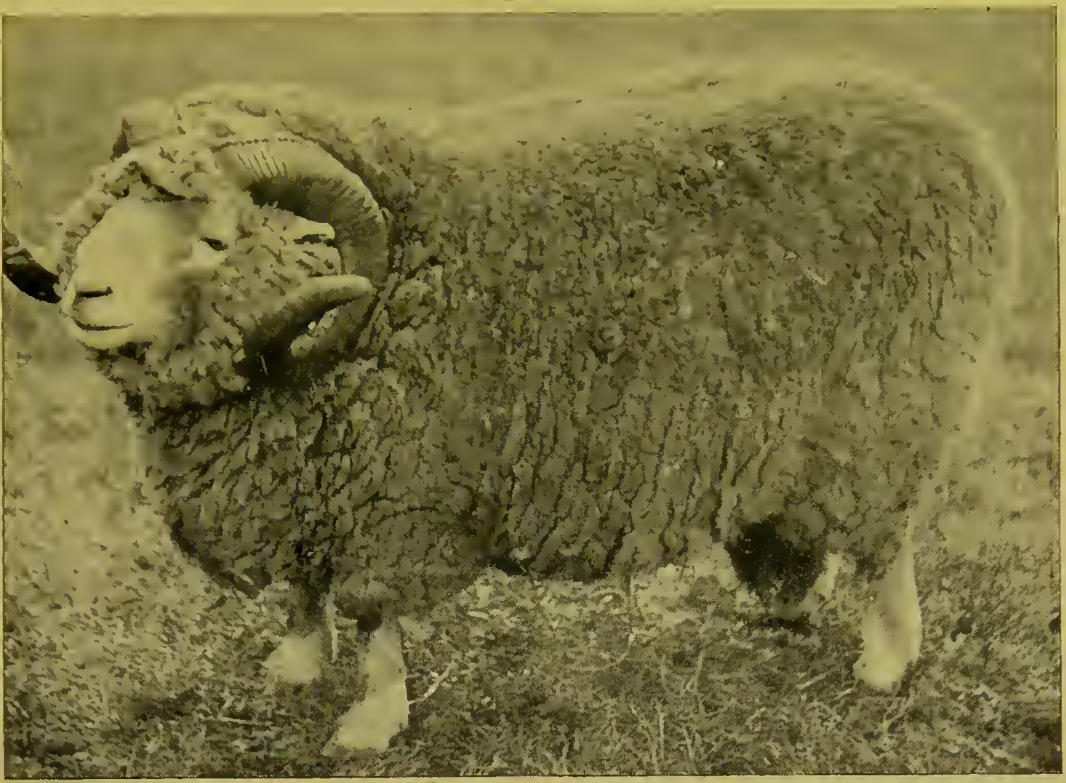
Dorset Horn Sheep. This is one of the comparatively few breeds which remain to-day of the same type as they have been for many years. The horns in the male are finely convoluted and deeply wrinkled.

The breed has been much improved by selection from within, but not by crossing, with the result that the weight of the carcases has been much increased, as well as that of the fleece. The type, however, is in the main what it was centuries ago. The sheep is moderate in size, the mutton being of a similar quality to that of Southdowns and Hampshires. The breed is numerous in the Isle of Wight, and it is from that locality and the coast of Dorset that the lambs for the London market are chiefly fattened.

WELSH MOUNTAIN SHEEP

This very ancient breed, which has flourished on the Welsh hills for many centuries, thrives equally well in highlands or lowlands, and the name of Welsh mutton is proverbial in the market. They are, therefore, naturally in great demand both in this country and in other sheep-breeding lands for purposes of crossing. Like all old hardy mountain breeds, they are somewhat slow in coming to maturity, but this has been improved, especially in the lowland districts, by judicious crossing of larger and earlier maturity breeds. As Professor Wallace says, the result of such a cross must inevitably be to produce an animal whose constitution is less hardy than that of the original pure-bred mountain sheep, and therefore it is only a desirable result when the cross can be kept in such an environment as gives it some protection from severe winter weather and a possible shortage of food. Pure-bred sheep have "yellow faces and legs, short fine wool, and show a narrow body descending towards the shoulder. The rams possess gracefully curved horns, while the ewes are generally hornless. The breed is noted for hardiness and for an activity which renders it difficult to fence in those which are taken down to the lowlands to feed. The mutton in the London market is regarded as of the finest quality, and classed with Scotch mountain mutton and that of the Southdown" (Wallace). Many farmers hold the opinion that the Welsh ewe is the most profitable one that can be kept for pur-

The Champion Lonk Ram, Copy, Nook Specimen

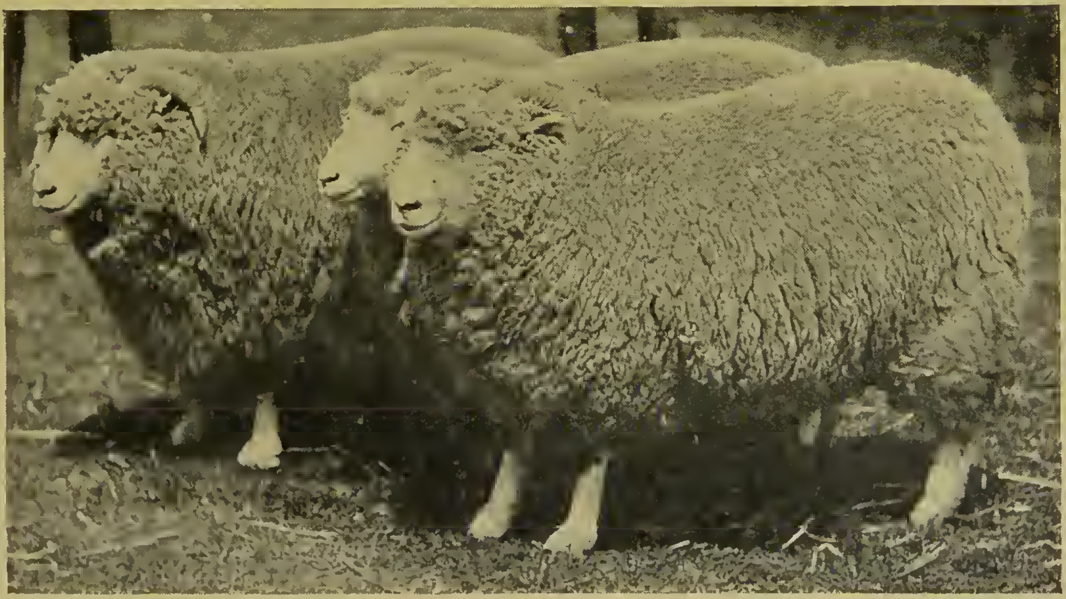


Prize Exmoor Horn Ram

poses of breeding, because not only does the animal require but little assistance in the way of feeding, but she also produces large lambs.

The Radnor Breed, one of the old Welsh mountain sheep, is still found, but not in any great numbers.

The Clun Forest Breed. This belongs to the district in Shropshire which the name indicates, and is now chiefly a Shropshire-breed animal.



Prize Exmoor Ewes (Shearling

The ewes produce Easter fat lambs, and the wether mutton is sold as Welsh.

There remain some lesser-known breeds of sheep which are more or less restricted in distribution to certain localities, or are for other reasons not so important in connection with the meat industry, and of these we may mention briefly the following:

The Exmoor Horn Sheep, from the Exmoor and Brendon Hills in Somerset, make excellent mutton from the two to three years wethers.

Lonk Sheep. The curious name of this variety takes its origin in the local word "lonk" in the north of England, which means coarse, long herbage, associated with grouse and sheep. The neighbourhood of Clitheroe and Skipton is one of those parts where the breed is well known. The lonk sheep is not unlike a Scotch Blackface except that the lonk is longer in the legs and body and head—in fact, longer generally—and has stronger horns in the ewe. The lonks are usually in small flocks of not more than two hundred. The wether-lambs, which are left over from the September killing, are reserved till the succeeding autumn, when they produce unusually lean mutton, which is in good demand in the manufacturing districts of Manchester and neighbourhood as well as among the workers in the Black country, amongst all of whom fat meat is much disliked.

Prize Herdwick Ram

The Rough Sheep. This is the horned Blackface Mountain sheep of the north of England, a smaller animal than the Lonk. Like many true mountain sheep, it is a slowly maturing variety of great hardiness of constitution, excelling in this respect most north of England related breeds. It flourishes on the bleak districts of Cumberland, Westmorland, and Lancashire, through which the passenger on the west-coast route passes in the train.

Swaledale Sheep. The dales of the north of England have given their names to many varieties of sheep, of which the Swaledale is one of the best known. They are favourites with the meat-dealers of Penrith, Kendal, and the Pennines. The ewes are good grazers and give good lambs when crossed with Wensleydales. Scotch Blackface sheep have also been used in the same way successfully.

Prize Ryeland Ram, Four-shear, Duplicate

Derbyshire Gritstone Sheep. This is a comparatively modern name for a breed which has been bred for more than a century in the dales and Peak of Derbyshire. It distinguishes them from the Limestone breed. The ewes are good mothers, and the lambs rapidly grow into meat of excellent flavour and of not undue fatness.

Limestone Sheep. These have long been known in their own locality in their home on the limestone of Westmorland, from which districts they extend somewhat. The breed has not been changed in type for ages, no other sheep apparently being able to flourish under the conditions found here. The bare mountain land with dry heath does not suit other kinds which have been tried experimentally. They produce mutton of a quality "unequalled by that of any other English breed except the Herdwick and the Welsh mountain sheep" (Wallace). The character of the ewes of coming into season at almost any time (like the

Prize Suffolk Ram

Dorset Horn) enables fat lambs to be produced for the Christmas markets.

The Penistone Breed. This breed is related to the Limestone, and

Prize Cheviot Shearling Ram

is characteristic of Penistone, on the borders of Yorkshire and Lancashire.

Old Norfolk Horned Breed. These sheep are now few in number, though formerly well known. "The wether-sheep are kept till three years old, and disposed of to the butchers at Newmarket Christmas market at prices up to six guineas each. The symmetry of the breed has been enormously improved by selection and in-breeding, and it now consists of remarkable, handsome animals with jet-black faces and legs, gay, high-set, expanding horns and black-spotted bodies. The ewes are very prolific, excellent mothers and good grazers, but they require a large roam. They never suffer from foot-rot, and so free are they from the common diseases that old age is the most usual form of death. When ready for the butcher, the Norfolk sheep carries a large proportion of lean, and no breed can show the same proportion of red meat to fat at the end of the saddle-cut" (Wallace).

The Herdwick Breed. These sheep enjoy the reputation of being the most hardy of all British mountain sheep, and they occur chiefly in the fell districts of Lancashire, Cumberland and Westmorland, where climatic conditions in the winter are of the most rigorous kind. Tradition gives them a romantic origin in an escape from a Spanish vessel wrecked on the coast in the time of the Armada; while another account gives Scotland as the place from which the wrecked ship had come early in the eighteenth century. Still another source is that put forward by the Rev. T. Elwood, of Coniston, who says that it was a Norwegian vessel in which the sheep were, and that they came with early Norse settlers.

The lambs when dropped have black or bluish heads and legs, with a white body or grey. At four years of age the white colour has extended so as to include the face and legs. The mutton is of excellent quality. The breed shows a tendency to increase in numbers.

Ryeland Sheep. This breed takes its name from a district in South Herefordshire, and the breed is chiefly found in the counties nearest to that locality. The breed is an old one and was formerly very popular but later were modified by crossing with Leicesters. The result was a change in the quality of both the mutton and the wool, concerning which various opinions have been expressed. Many Herefordshire breeders believe that Ryeland ewes produce fat lambs better than any other class. Mr. J. Marshall Dugdale mentions an instance of a large New Zealand sheep-buyer expressing the opinion that the cross between a Ryeland ram and New Zealand ewe produces the best lambs for the butcher as well as the best cross-bred wool. The breed has the advantage of being able to flourish on very poor quality of pasturage, though, of course, the best results are obtained from the best land.

Suffolk Sheep. This breed was formed from a cross between Blackface Norfolk horned ewes with Southdown rams, and it is said to have many excellent qualities, especially those of early maturity, hardiness of constitution and the capacity for producing extremely good mutton of an unusual lean quality. It is a breed which stands travelling over long distances extremely well and very rarely suffers from foot-rot.

Suffolk Sheep in 1909. "A successful year may again be reported, a feature of the season being the excellent demand for the best quality Suffolk sheep at home and abroad for pure-breeding and crossing purposes. At the 1908 Smithfield Show the reserve number for the champion plate in the Short-wool section—100 entries—was awarded to a pen of Suffolk wethers bred by Mr. H. E. Smith. In the carcase competition at that show—the greatest test yet instituted for mutton quality, the awards representing the verdict of the meat-salesman, whose standard is the public taste—Suffolks were awarded, in open competition, the champion prize (best carcase in the yard) for the sixth time in seven successive years, and first prize for short-wool lambs for the ninth year in succession, fully one-half the total other awards also going to Suffolks and Suffolk crosses. In the live section of the Smithfield Show the average daily gain in live weight of the third prize Suffolk wether lamb was 0.77 lb. (that of the five Suffolk lambs exhibited working out at 0.74 lb.), while the Suffolk Border-Leicester lamb, commended in the cross-bred classes, showed an average daily gain of 0.83 lb., higher averages than those shown by any other exhibited pure or cross-bred lamb or sheep respectively." (*Live-stock Journal Almanac*, 1910.)

PRIZE AGED WENSLEYDALE RAM, PROUD PRINCE

Crosses from Suffolk rams are very much in demand from butchers as the carcases are good and lean; in fact, perhaps "no other British breed produces a saddle-cut of mutton with such wealth of lean red meat in proportion to fat as the Suffolk and the old Norfolk breed" (Wallace). Suffolk sheep have been largely exported to the Colonies, Europe, and America.

Cheviot Sheep. This is a mountain breed which takes its name from the range of hills on the English border, in the neighbourhood of which the sheep are chiefly found. "No sheep thrives better on the plains of the Canadian North-West, and, being hardier than any of our low-country, Long-wool or Down breeds, it has a hopeful future in other foreign parts, when quality *versus* quantity of mutton and the cost of producing wool per pound, and not the amount per sheep, become more important factors than they are at present. The breed, which usually produces mutton of the finest quality, has one defect as a butcher's sheep in the occurrence of more than a usual number of yellow carcases, which do not fetch top price" (Wallace).

Authorities and References. Space does not permit of our entering into further detail in connection with the various breeds of sheep, nor is it necessary for the purpose of this work, but we would refer our readers to the following publications and writers, from which sources we have taken much information and are thereby indebted: Professor Robert Wallace's "Farm and Live Stock of Great Britain" (Oliver and Boyd), "Encyclopædia of Agriculture" (Wm. Green and Sons), the herd-books of various breeds, the writings of James Cameron, A. S. Grant, Professor Wrightson, W. W. Chapman, G. MacQueen, J. C. Ashworth, T. A. Buttar, J. Marshall Dugdale and W. Parlour, and the *Live-stock Journal Almanac*, 1910.

The photographs of the different breeds in the foregoing pages are by Mr. Parsons, Alsager, Cheshire.

CHAPTER IV

THE FEEDING OF MEAT ANIMALS

One of the most important problems which face the owner of the various kinds of animals which are reared for the object of producing meat is how to so feed them as to obtain the most profitable results at the least expense. The problem is, of course, more complicated in such parts of the world as require the animals to be specially protected in certain seasons of the year, or where the meat-producer is confronted on every side with severe competition, which makes it necessary for him to have his animals fattened by definite dates or with considerable rapidity. This is practically the state of affairs in Great Britain. We need not here consider the necessity of the feeding of animals in those parts of the world where they can live an out-door life all the year round or until such time as they are required for slaughtering. It will be sufficient if we confine our attention to our own conditions and environment, and the animals with which the British meat-producer is mainly concerned. Since, moreover, we have dealt with the feeding of poultry in a separate section of this work, it only remains to say that in this chapter we shall consider the feeding of meat-animals with special reference to cattle, sheep, and pigs.

In order that this problem may be discussed and understood in a thorough and scientific manner, it is obviously essential at the outset to devote a little attention to the physiology of the process of digestion, and, secondly, to the consideration of the varying anatomical arrangements of the digestive organs in the animals we have mentioned.

The Process of Digestion. By the term digestion is meant the process by means of which different types of foods become broken down into more simple substances, which are then capable of passing through the mucous membranes of the digestive tract and thence into the blood. Properly speaking, the term digestion includes everything which enables this to be done. It is usual to regard all the different foods as being capable of division into three great groups, namely, proteins, carbohydrates and fats. Of these three groups of food materials the proteins are, perhaps, the most important, and are extremely complex substances from a chemical point of view. All food-stuffs contain protein, or practically all, although in very different quantities and proportions, and the universality of protein will be at once recognised if it be remembered that this is the essential constituent of protoplasm itself, which latter substance is, of course, the basis of all cell-life. Proteins are, however, not capable of diffusing through a mucous membrane, and it is this fact which makes digestion such an important process. A simple example of a protein food-material is white of egg, which cannot be absorbed as food until it has been acted upon by the digestive fluids. This digestion of protein takes place in the stomach and in the small intestine. In the former organ the pepsin of gastric digestion, together with hydrochloric acid of the stomach, breaks down the complicated food-stuff into such materials as are diffusible, and the process is continued still further into the intestine until eventually all the protein portion of the food becomes converted into peptone, most of which is absorbed into the blood.

Digestion of Carbohydrates. These substances are not so complicated from a chemical point of view as are proteins, and may be regarded as consisting of starches and some sugars, the former being the more important. These starches are the principal basis of the food in such ordinary articles of diet as bread, rice, carrots, turnips, swedes, potatoes, and vegetables generally. They are not diffusible in that form, and therefore require to undergo digestion, which is effected by means of the secretions of the salivary glands (saliva), the pancreatic glands (pancreatic juice), and some other secretions, the result of which action is to convert these starches into diffusible sugars.

Digestion of Fats. In animals' digestion fats do not play such a prominent part as do the proteins and the carbo-hydrates. Fat is nevertheless an important constituent of some animal foods, such as maize and oats, in which it forms no less than 4 per cent. None of the digestive agents already mentioned are sufficient to transform fat into the conditions required for its assimilation, that is to say, neither saliva nor gastric juice will do this. Digestion of fat takes place chiefly as the result of the action of the bile from the liver and the pancreatic juice in the small intestine. In the latter digestive agent there are important ferments which transform fat into fatty acids and glycerine, in which state they can be absorbed, only once more to unite again later in the shape of ordinary fat. It will thus be understood that what we know as the process of digestion is essentially to be regarded as including all the various processes by means of which the different kinds of food-stuffs are enabled to pass through the lining membranes of the alimentary tract, and ultimately into the blood-stream.

Other Constituents of Food. In addition to the three groups of important food-stuffs whose digestion we have been describing, it must also be remembered that in all foods there is a certain percentage of water, which is that quantity of any food-stuff which disappears on drying a simple food in a state of fine division at a temperature of 100° Cent. This amount of water in varying food-stuffs differs immensely. Thus, fresh beetroot contains 93 per cent., roots from 58 to 90 per cent., green food 70 to 90 per cent., hay and straw 12 to 17 per cent., cereals 11 to 15 per cent., oil-cakes 9 to 13 per cent. The bearing of the quantity of water in any given food-stuff is important, because on this factor depends not only partly its feeding value, but also its keeping qualities. Then there are some substances of a non-protein nature but which contain nitrogen, and which are principally found in young tender shoots of plants and meadow-grass, becoming less and less as the plant approaches maturity. These substances, too, are greater in amount in those plants which contain much water, or in food-stuffs which have been acted upon by fermentation. We have also to bear in mind that food-materials contain a residue of crude fibre which is a mixture of cellulose and other substances, and, finally, there is a certain residue of mineral substance or ash. This last is made up principally of potash, soda, lime, magnesia, compounds of iron and other salts, all of which have, in the first place, been derived from soil.

The Process of Digestion. Having thus briefly considered the various components of the food-materials which have to be digested, we may next direct our attention to the actual process of digestion itself. This begins from the moment at which food enters the mouth, and therefore includes the functions of mastication and rumination, as well as later digestive changes. As far as the meat-animals are concerned, the processes differ according as to whether we are dealing with the digestion in an animal with a simple stomach, such as a pig, or with an animal in which there is a complicated stomach, such as the sheep or ox. In these latter there is the added process of rumination, and they are hence called ruminants. In the pig, where the stomach is simple and rumination absent, mastication is performed once and for all, but nevertheless in this particular animal there is but very little actual chewing, which makes it all the more important that the food given to pigs should be either soaked or boiled, in order to render it easily acted upon in the stomach. The ruminants, however, possess much more elaborate arrangements for dealing with food than do pigs, and so it comes about that cattle and sheep are much more capable of making use of food-stuffs of a hard and fibrous nature than are pigs. This is due to the arrangement of their compound stomachs, which consist of four divisions, and into which the food is passed with but very slight preliminary mastication. The subsequent digestion, as far as the four stomachs are concerned, is thus described by Professor Kellner :

The Food in the Stomachs. " Each mouthful passes to the first two divisions of the stomach—the rumen and the reticulum—which may be simply regarded as store-places for the food. In these two compartments of the stomach the food is thoroughly mixed with the saliva and any water which may have been drunk, the walls of the stomach assisting in the process of mixing. Some time after eating, small portions of the softened food are brought up again (regurgitated) into the mouth, where they are masticated and salivated for a second time. The return of the food to the mouth is performed by the help of special muscles aided by gases, such as carbon-dioxide and marsh gas, which arise from the food. After remastication, the food passes chiefly to the third stomach (omasum, manyplies, or psalterium) by way of the œsophageal groove. The cavity of the omasum is divided by means of leaf-like extensions of the mucous membrane provided with special muscles, giving a sieve-like structure.

By the slow contraction of the walls of the omasum, and by the rubbing together of the leaf-like membranes, the food is still further kneaded and ground up. When it is sufficiently fine it passes to the fourth division of the ruminant stomach, the abomasum or rennet, which is the real digestive stomach, and resembles the simple stomach of other animals. The abomasum and the succeeding portion of the alimentary canal —the small and large intestines—undergo peculiar movements when food is in them. From the similarity of these movements to those of a worm they have been called the vermicular movements, and they serve to further disintegrate the food and mix it with the digestive juices."

As we have already seen, the various food-elements, after the processes of mastication, gastric digestion and rumination, pass then into the small intestine, where they are further acted upon by the bile and the pancreatic juice, the former acting especially upon the fats. Finally, those portions of the food-stuffs which remain undigested are expelled from the alimentary tract periodically, the duration of the digestive process differing in various animals.

" In the case of the ox the alimentary canal is twenty times as long as its body, in sheep and goats it is twenty-seven times, in pigs fourteen times, whilst in the horse and donkey it is only eleven to twelve times the body-length. Similar differences are also to be noted in the capacity of the stomach and intestines, for the ox can hold on an average 365 kilograms (1 kilo. = 2.2 lb.), the horse 211 kilos., and the pig 23–31 kilos. Thus it follows that the length of time which elapses before the undigested part of the food is expelled as fæces varies considerably. With cattle and sheep it takes on an average three to four days, whilst with pigs thirty-six hours suffice " (Kellner).

Differences of Digestion Explained. Part of the explanation of the differences of the digestion of the various animals is to be attributed to the varying lengths of the alimentary tract and its varying capacities. Thus we find that digestion in different breeds of animals of the same species is always about the same, except for slight individual variations. Age does not appear to make much difference, nor does the factor of whether the animal is at work, or at rest, appear to have much influence though Professor Kellner states that the rate at which the work is being done does make a difference. The same authority states that the conditions under which animals are placed have no influence upon the digestibility of their food so long as great excitement and actual disturbance of health are avoided. That is to say, the ordinary variations of temperature, lighting, and ventilation do not appear to exert any effect, nor does the process of shearing in sheep. The same proportion of the food is digested, no matter what actual amount of it is taken in the case of coarse fodder. When, however, very large quantities of food which is easily digested are given, some escapes unabsorbed, so that over-feeding for purposes of fattening has its limits. Excessive addition of digestible carbo-hydrate produces a certain amount of loss of digestive power, as has been proved experimentally in the case of both ruminants and pigs.

The addition of fat to a food, so long as it is in a state of fine division and in no larger quantity than one pound per one thousand pounds of the body-weight, does not alter digestibility. If, however, melted fat in large quantities is poured over the food its digestion is considerably impeded, since it is with difficulty that the digestive secretion can reach the food.

Finally, it may be mentioned in this connection that the various condiments have no appreciable effect in increasing animal digestion, which, under healthy circumstances, has apparently no need of any such assistance.

Duration of Rumination. There is considerable difference of opinion as to the time required for this process. Some observers, estimating the ordinary meal at 12,000 grammes, consider that not less than 520 ruminations will be required, occupying somewhere about seven hours. Professor Kellner gives from three to four hours as the minimum time required for the rumination of the food, while Professor Farquharson estimates that it cannot be much less than from five and a half to six and a half hours. Absence of fluid in the stomach hinders or prevents rumination, which almost always begins after drinking water. The amount of water required will obviously differ according to the dry or moist nature of the food taken. Other factors affect the process also ; thus, sudden alarm or fright, as well as the onset of pain, may cause rumination to cease at once.

Digestion in the Pig. In swine, the stomach, although very much simpler than that of ruminants, is not so simple as that of purely carnivorous animals. Some authorities divide it into several areas, one of which is an œsophageal pouch in which there is no gastric secretion, these portions of the stomach being therefore analogous to the first and second stomachs of the ox. In the true digesting portion the process is very thorough, though somewhat slow, but, on the other hand, the absorption of the food when it is digested is comparatively rapid.

Comparative Anatomy of the Stomach. The various illustrations in these pages, together with the models at the commencement of our volume, will serve better than any mere description, to illustrate the different anatomical differences which exist in the stomachs of cattle, sheep and pigs. It need only be mentioned further here that, with regard to the complex stomach of the ruminant animals, three out of the four portions of that organ may be looked upon physiologically as dilated portions of the lower end of the gullet, since they do not secrete true gastric juice. Their function is merely that of retaining the food for a given period of time or mechanically dealing with it. It is only in the fourth stomach, or abomasum, that actual digestion takes place. It will be remembered that the ox gathers its food by means of the long mobile tongue, after which the food is partially masticated and transferred principally to the rumen. This enables large quantities of food to be taken in while grazing ;

moreover, it allows of the preliminary mixture of saliva. After grazing is finished the process of rumination at once begins. The food is forced back into the mouth by the muscular contraction of the walls of the rumen, and is now thoroughly masticated, after which it returns to the three or four stomachs.

Having thus briefly sketched the structures necessary for digestion and the different natures of the food-elements themselves, we may pass on to consider the important practical question of the feeding of the meat animals for the purpose of fattening them for market.

Some Facts of Food and Metabolism. From the vast number of experiments on feeding, and from the analysis to which we have referred, the following facts, amongst others, have been ascertained. Animals will continue to live for a considerable time, even though they be deprived entirely of food. They do so, however, at the expense of the tissues in the body, especially at the expense of the fat, owing to the necessity for the production of heat and energy. Decomposition of tissues is always going on, and this only ceases with life itself, and the total loss of heat depends chiefly upon the surface of the body of the animal, smaller animals using up more heat than large ones. This loss of heat, which is, of course, a measure of the activity of tissue-changes, varies considerably with the temperature in which the animal is placed. Both fat and protein are concerned in heat-production, and the fatter the animal is, the greater is the part played by fat itself in producing heat. As the fat disappears in an animal which is becoming leaner and leaner from want of food, so more and more do the proteins come into action as heat-producers. " A starving animal lives upon the materials of its body. The amount of heat which it gives out serves as an exact measure of the requirements of the body in material and energy. If such an animal is given food, which brings heat and energy, it is clear that body-tissue equal in quantity to the heat which is liberated from the food in the body will be saved " (Kellner).

It is only within comparatively recent years that our knowledge concerning the feeding of animals can be said to have been placed upon a really scientific basis. Before that could be done, it was necessary to carry out great numbers of analyses of various food materials, and furthermore, to ascertain by actual experiment the precise use and effect in the animal economy of the different kinds of food-stuffs. Fortunately, we now have at our disposal a large mass of information concerning the utilisation of the various digested nutritive agents in the animal body. We have also considerable knowledge as to those parts of the tissues which are principally affected by withholding of food, or certain elements of food, as well as the results of supplying abundant nourishment. It would be beyond the scope of this work to enter into great detail on these matters, but their importance in deciding upon a scientific system of feeding animals for the meat market is so obvious that we would draw the attention of our readers to the fact that this information is available, and would particularly recommend them to consult Professor Kellner's book on the subject, from which many of the foregoing and the following facts are taken.*

What the Meat-producer aims at. If we now take the case of an animal which is having an abundance of food supplied to it, it is, of course, obvious that certain proportions of that food go towards maintaining the animal in normal condition, or functioning, while any excess over that necessary for this purpose is available for increase of the animal tissues or for the production of actual work. It is the former point, the addition of extra tissue, which is the object aimed at by the meat-producer. Amongst the other substances which are absolutely necessary for this result the proteins are of the greatest importance, no matter what else there may be in the foods ; unless the supply of protein is adequate, the animal is compelled to obtain the supply from its own tissues, and ultimately suffers from starvation.

It has been proved that a large excess of protein given to an adult animal causes respiration to be more rapid and the supply of blood to the skin to increase. Sometimes, also, the body temperature rises. All these symptoms indicate increased metabolism of material and of energy, and lead to the decomposition of more protein. This may, in fact, go so far that the body-fat is also included in the increased decomposition.

Animals whose limit of growth is not yet reached behave quite differently with regard to the greater part of the excess of the food proteins. They utilise them in the body for development of the organs without the effects noted above being observed, as is the case with adult animals.

For example, full-grown sheep retain as a rule 10 gr.—at most 15 gr.—of protein daily in the body, most of this, if not the whole, going to form wool. Lambs, on the other hand, in spite of the smaller body-weight, are able to store 40–50 gr. daily. Investigations with sucking-calves have shown that these animals are able to utilise 72 per cent. of the protein of the milk for the formation of flesh, which is a very high percentage.

Experimental Results. It has been repeatedly shown by experiment that protein is not necessary in order that fat may be formed from carbohydrates, but nevertheless it has also been shown that a certain amount of protein is necessary in order that the digestibility of food shall be maintained. The total result of experimental investigations in connection with the action of digestible food-elements may be stated as follows : The flesh in the body is formed chiefly from protein. Some nitrogenous substances, not proteins, can be changed in the intestine into protein by means of bacterial action. This change, however, is only possible to any considerable extent in the alimentary tract of ruminants ; in pigs, on the other hand, it is either very slight or absent. Substances free from nitrogen, as well as fat itself, although they do not directly form flesh, assist in this production by helping to decrease the decomposition of the proteins in food so that more is free to form flesh. Finally, the fat which is added to the body can be obtained either from that supplied in the food or from nitrogen-free substances and crude fibre.

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* "The Scientific Feeding of Animals." By Professor O. Kellner, translated by William Goodwin, B.Sc. (Duckworth and Co., London.)

Mastication and Digestion. It will be readily understood that in the case of all the coarse foods there is a considerable amount of work required for both mastication and digestion, with the result that the finer the food the better will it be utilised. Kellner states that the decrease in productive value was experimentally shown to be 5 per cent. greater in coarsely chopped straw than in the case of finely ground straw.

He further says that the improvement due to grinding is greater in the case of wheat-straw than with barley- or oat-straw, and that the limit in case of the wheat-straw is reached when the particles are about as large as in the chaff. In addition to the factors of mastication and digestive powers, there is a certain amount of decomposition which goes on in the intestines, which is also a factor which must be estimated in accounting for the utilisation of food-stuffs, and these three factors are all intimately concerned with the qualities of hardness of the food materials. This hardness is mainly determined by quantity of crude fibre present.

It is, of course, much easier to masticate fodder in a green state than when dry, the exact amount of extra energy required varying with the age and species of the plants concerned. It has also been proved that cereal grains without husks are of full value as food, whereas the various by-products in which the internal nutritive portion of the grain has been extracted by some mechanical means are of low value as foods. As example of these may be mentioned bran, barley refuse and brewers' grains.

Mineral Matter in Foods. We have already referred to the fact that certain mineral salts are an essential constituent of food, and, as a matter of fact, if these constituents be withheld the animals show, sooner or later, symptoms of weakness in the muscles, trembling, cramp, and other symptoms, and death occurs even more readily than in starvation.

These mineral matters are very evidently, therefore, absolutely necessary to growing animals, in which they undergo various changes just as do other food-elements. Of these minerals we may note the effects of potash, soda, lime, magnesia, phosphorus, and iron. Potassium occurs principally in the walls of animal-cells and blood-corpuscles, and in muscle, but its exact functional importance is not well understood. Sodium occurs in blood, lymph, saliva, gastric secretion and elsewhere, and is especially combined with chlorine in the form of common salt. This substance is of immense value and importance, and serves quite a number of functions. When present in mo erate quantities in the food it probably hastens flesh formation, though, if present in excess, it induces to greater thirst, and therefore has the same ill effect as the administration of a too liberal supply of water. Fortunately, most food materials contain a sufficient proportion of salt in their composition to supply the ordinary needs of the animal. Some extra administration of it is, however, called for in cows which are giving milk, the necessary element here being apparently the chlorine. Salt also has the action of a condiment inasmuch as it renders food more palatable, improves the appetite, assists in the production of gastric juice and also helps the circulation. It is therefore extremely important that it should not be deficient. As regards lime, magnesia, and phosphorus, it may be noted that these substances are principally important in connection with bone-formation, and in their absence disease of the bones rapidly manifests itself. This absence in the bones may be due either to an absolute lack of the elements concerned in the food given or it may be due to some morbid condition on the part of the tissues which renders them incapable of assimilating these substances even when they are available in the food. Whichever be the case, the results are seen in such diseases as rickets and osteomalacia. These conditions are observed more commonly, perhaps, in pigs than in cattle or sheep, as the latter animals, feeding as they do more upon hay and other fodder, are able to obtain their lime-salts from these sources. The food-stuffs which are particularly lacking in these elements are the straw and chaff of cereals, bran, roots and molasses ; whereas clover, meadow-hay and various seeds contain a given proportion of lime. The lack of phosphorus is to be noted in straw and chaff of cereals, mangels, potatoes, brewers' refuse, and molasses ; while phosphorus is present in good proportion in grain, bran, oil-cakes, and fish-products. It only remains to be added that lack of iron seldom shows effects in domesticated animals, most of the food-substances containing all that is required.

Water and Food. It goes without saying that water is an extremely important element in animal food-stuffs, as it is in the animal economy, and that its functions are various. First of all, a certain amount of moisture is almost necessary in order that food should be swallowed at all, and, moreover, it assists in the mastication of it. It is necessary both for digestion and subsequent absorption, because solutions which are insufficiently watery cannot pass through the alimentary mucous membrane. It further acts as a carrier of nutritious particles in the circulation and in the lymph, as well as in excretions. In addition, by means of its evaporation over the surface of the body, as well as from the lungs, it is concerned in the loss of body-heat which, indeed, under some circumstances would be difficult to get rid of otherwise. In a word, it is quite impossible for tissue metabolism to be carried on in a healthy manner unless there be a sufficient quantity of water in the body. In its absence, all the fluid portions of the tissues are hindered in their proper work, and if water be withheld for any length of time a condition very like that of fever occurs. It is especially in young and growing animals that care should be taken to supply the requisite water at regular intervals ; indeed an animal will suffer less from a period of actual starvation than it will from a period of enforced absence of water. There is not much fear of animals taking more water than is good for them so long as the food they are eating does not, in itself, create a desire for water. Thus, if animals running in a pasture, having access to a water-supply without hindrance, are observed, it will be found that they drink an amount which is in fairly constant proportion to the dry portion of their food. If, by any means, it happens that the proportion of water in the food is constantly in excess of that required, various results follow. In the first place, digestion is impeded owing to the excessive diluting of the gastric-juice and other secretions, and in time the tissues come to contain an excessive amount of water.

Factors in the Feeding of Animals. Owing to the simple fact that ordinary water has to be raised to blood-heat in the body, it follows that the temperature of the water makes some difference as to the amount actually available for the use of the body itself. The importance of this, however, varies in different animals ; thus in the ruminants which are being well fed there is a production of heat which is in excess of that actually required, and a proportion of this excess is therefore available for heating the water without occasioning any loss to the animal. If, however, the food-supply is deficient, then there will be some actual loss. Again, in the case of pigs, which lose heat readily on account of the absence of a thick coat of hair, the administration of large quantities of cold and wet food means that some of it has to be used up in heat-production, and this is, therefore, a loss as far as nutrition is concerned. It is therefore a good custom to administer part of the food to these animals in the shape of warm liquid at a temperature of about 55° Fahr. The water itself which is supplied to meat-animals, as indeed to any other animals, should be of the best quality possible.

Since we are discussing animals from one aspect only of their usefulness, namely, that of providing meat for food, there is no occasion to enter into any discussion with regard to the utilisation of food for the production of muscular work. Neither is it necessary for us here to enter into any detailed account of the composition from the point of view of nutritive value of food-stuffs, nor is it necessary to describe the preparation of the various foods. All these points have been the subject of great investigation, and have been described at length by various authors.

We are, however, only concerned here with the feeding of the various meat-animals under the ordinary conditions usually found in this country, and concerning that something must be said, especially from the point of view of fattening for the market.

Diet for Fattening. It is not possible to add extra quantities of fat to the diet of animals to an unlimited extent, since an amount greater than 1 lb. of fat for every 1000 lb. of live weight is found to interfere with the appetite and digestion in adult herbivorous animals, though a somewhat larger quantity can be given the young growing animals. So that it is necessary to pay attention both to the quantity and quality of the fat-producing elements. In addition to this, wherever it is intended to fatten animals quickly care should be taken that the food itself is of a palatable nature, and in order that this may be better attained the diet should be as mixed as possible. This plan has the additional advantage of distributing the work of digestion over the different parts of the alimentary tract, the size and complexity of which must always be taken into consideration in formulating a diet. Whenever it becomes necessary, for any reason, to make alterations in the food given, these changes should be introduced gradually, so as to enable the digestive organs to cope with them without having any sudden strain thrown upon themselves. A good plan in this connection is to spread the alteration in diet over a week, at the end of which time the new food material may have reached the full amount it is intended to give. The greater the contrast between the new diet and the old one, the more gradual should this introduction be, and the longer the time which is allowed to elapse before reaching the full quantity. It is of great importance, also, to recollect that the nutritive value of food is considerably increased by giving it in several distinct quantities rather than in one large amount at a time. "The capacity of the digestive organs and the behaviour of animals free to eat when they wish point to the division of the ration into three, or at most four, meals for full-grown animals, and four to six for young ones, as being most natural. When large quantities of fodder are given at one time, portions are very liable to be thrown about and to be trodden under foot. Regularity in the times of feeding plays a not unimportant part in the comfort and well-being of the animal. By a suitable admixture of tasty foods with those that are not so readily eaten, the appetite of the animal is maintained to the end of the meal, and so the ration is fully consumed. With ruminants and horses it is usual to first give coarse or green fodder and then the mixture of chopped hay, or straw, or roots and concentrated food ; this ensures the consumption of each portion of the ration before the next is taken. Finally, some long hay or straw, for the animal to eat at leisure, should be given. The order in which the food is fed can be altered according to taste, so long as the chief end—a complete consumption—is attained" (Kellner).

The Place of Salt and Water in Food. With regard to the actual amounts and constitution of various diets for purposes of fattening, mention may be made here of the fact that the amount of salt needed by a cow of average weight is from ¾ to 1½ oz. per day, while that for a sheep or a pig is up to ¼ of an oz. This element is frequently given in the form of rock-salt, a lump of which is placed in a convenient position for the animal to lick whenever it pleases. The disadvantage of this method of giving salt is that the amount consumed is impossible to control, and the animal is apt to take too much. The better plan is to mingle the salt with the food in the definite quantities required, only adding to the figures mentioned above in those cases in which the food is difficult to digest, when the amount may reach 2½ oz. for cattle and ½ oz. for sheep and pigs. In no case should these quantities be exceeded.

In the case of cattle it is well to allow as much water as the animal desires after the first part of the dry fodder is consumed, and probably sheep and pigs thrive best when they have available a water-supply from which they may help themselves whenever they feel inclined.

Fattening of Full-grown Animals. We have thus far spoken chiefly of feeding and food-supplies from the point of view of their nature, uses, and digestion in animals which are simply living the ordinary life, and the diet necessary for such may therefore be described as a maintenance diet; that is to say, a diet which is sufficient, under ordinary circumstances, to maintain the animal in such a state of health that it grows naturally. We now come, however, to the final problem in connection with feeding, namely, that which is concerned in the fattening of animals which are already full grown. The conclusions arrived at in this matter are those which have been determined by experiment. The experiments consisted in weighing oxen, pigs, calves, and lambs, some of which were lean and some of which were fat, at different intervals during fattening, and finally analysing the body substances in order to ascertain which tissue-element had been the seat of the increase. Broadly speaking, these experiments show that the principal addition made to the body during the process of fattening is composed of not less than two-thirds of fat, one-quarter of water, and a very slight quantity of nitrogenous matter, most of which last goes to the blood.

There is, therefore, a comparatively small increase in the number or size of the muscle-cells which compose the flesh, so that the general law may be stated that when animals in good health are put upon special diet for purposes of fattening, the result is practically no addition to the flesh of the body, but the production of an increased quantity of fat itself. This statement does not apply to animals which are in an extremely poor condition to begin with, because in that case the animal has first of all to reach normal standard of fleshiness, during which it is enabled to utilise a larger quantity of protein matter than it can do after that standard has been reached. In the case of cattle, fat itself must enter largely into the diet for fattening purposes up to the quantity which has been previously mentioned, of which 1½ to 1¾ lb. of digestible fat is about the limit. Pigs and young animals may be able to assimilate rather more without digestive disturbance. In another portion of this book the effect of various foods upon the production of bacons is described, and need not be repeated here.

Fattening Adult Ruminants. The cheapest method and the cheapest diet for bringing adult ruminants to the required state of fatness is that which does so most rapidly, since the longer it takes to bring the animal into the required condition the more food has obviously been consumed, simply for purposes of maintenance.

During the process of the fattening, the change which is taking place in the animals concerned is shown by their increase in live weight, especially during the earlier part of the fattening process. This change does not go on regularly throughout a whole period of fattening, but becomes less and less marked towards the end of that time, because, of course, the greater the amount of tissue added the more food is required for actual maintenance. Experiment shows that fat animals require about twice as much food to keep up 100 lb. of weight gained by fattening as they do to maintain an equal amount of weight in the lean condition, and it is this fact which makes the fattening process more expensive and costly towards its conclusion. The taste of the modern consumer, however, seems to be rather in the direction of a dislike of over-fattened meat, and the process therefore must not be carried too far. Finally, we may mention that when the fattening has been attained, the idea of the owner, of course, is to sell the animals at once; but it may be impossible to obtain a ready market just at that moment, and if so, the plan to be adopted should be to gradually reduce the special fattening diet, keeping it at that which will maintain the animal in the fat condition, this being accurately estimated by periodieal weighing.

The point to be remembered in this connection is that when cattle are being rapidly fattened they manufacture far more heat in their bodies than they do on an ordinary maintenance diet, and some of this heat must be got rid of, hence the temperature must not be too high or else there will be difficulty in doing so. This is the reason why it is more difficult to fatten cattle in the summer than it is in the winter. An average temperature for the stall may be stated at from 50° to 60° Fahr.

Fattening and Shearing. The shearing of sheep has a bearing upon the fattening of these animals which is similar to that just mentioned, namely, it is a question of allowing more readily of loss of heat from the body, thus ensuring that the appetite is kept up. "It thus acts as a preventative of over-heating of the body, which easily arises from rich feeding and a warm stall, and which would lead to an intake of an insufficient amount of food. In the colder periods of the year shearing is only of advantage when very intensive fattening is being carried on in a place where the temperature is fairly high. When, on the contrary, the ration is only a medium one and the stall temperature low, there is no advantage gained by this operation" (Kellner).

Foods and Fattening. Some foods, which are excellent from other points of view, are useless for obtaining quick results in fattening. Thus, even excellent meadow-hay, or hay from clover, is not of high value for this purpose, though, on the contrary, young growing plants on good pasture-land are excellent material for the object in view. Care must be taken, however, that when animals are first put on to such rich pasture they do not over-feed themselves with these highly nutritious plants, and this is best prevented by giving a small quantity of hay before turning them out. According to the quality and fattening capacity of the particular pasture, the owner will decide what additional fattening foods may be required. It is commonly most convenient and rapid to carry out the last stage of the fattening process in the stall in the case of cattle. This is partly due to the fact that as long as the cattle are turned out in the pasture they are utilising a certain amount of their food in muscular effort and exercise, a certain amount of which is saved while they are at rest in the stall, though, on the other hand, there may be some slight loss of appetite under the more confined conditions. "Where green fodder is given in the stall, the same degree of fattening can be reached as with dry food, only the rations must, of course, be supplemented by other foods according to the nutritive value of the green food. Where the green plants (clover, lucerne, vetches, &c.) are rich in protein the addition should be in the form of cereals, grains, or maize, rice-meal, dry beet-slices, or other carbo-hydrates or other fatty foods, whereas in the opposite case the protein-content can be raised to the necessary degree by means of oil-cakes, dried brewers' grains, ground leguminous seeds, &c. In most cases the process of fattening is carried out by first using whatever hay or straw is to be obtained from the farm as well as the cheaper roots (mangels, carrots, turnips). Where the price of potatoes, beet-slices, molasses, lupines, brewers' grains, potato-pulp, &c., is low these should also be chosen, and any deficiency made up with suitable concentrated foods" (Kellner).

The Animal's Comfort. An important point, which is, however, often omitted, is that attention should be paid to the general comfort of the animal which is being fattened. The point to be aimed at is to produce such a general state of surroundings that the animal has nothing to do but be as lazy as possible, as comfortable as possible, with as little exertion as possible. One way in which this condition may be attained is to see that there is an ample supply of comfortable bedding so that the cattle may be tempted to pass as much of their time as possible lying down. The erect attitude involves a certain amount of muscular work, and, as a matter of fact, it has been shown by actual experiment that tissue-metabolism is about one-third greater in cattle standing up than it is when lying down. Another point in this connection is that the temperature of the stall should not be too high, though, of course, there should be sufficient warmth for comfort.

Amount of Food for Fattening. Experiment has also shown that the quality of meat in cattle is improved by giving in the food those substances which tend to soften the fat, which, it may be noted, is exactly the contrary to that which takes place in pigs. As regards the amount of fodder to be given to adult ruminants for fattening, Professor Kellner advises that about 10 to 15 lb. of coarse fodder to every 1000 lb. of live weight should be given daily, excluding in this estimate concentrated food and roots. A ration such as this would contain about 25 to 35 lb. of dry material, which, divided into its digestible component parts, would give about 1.6 lb. protein, 0.7 lb. fat, and 16 lb. nitrogen—free extract substances and crude fibre in addition to starch to the amount of about 14½ lb. If less coarse fodder is being given, the amount of starch may be decreased to an equivalent of 12 lb. instead of 14, which will, nevertheless, not interfere with the addition of 2 lb. weight per day to the animal. In choosing the actual feeding-stuffs for fattening cattle and sheep, preference should be given to those which are most digestible and which contain the required amount of water, assuming that they are equally palatable. Thus it would be useless to expect any great increase of weight if straw and chaff and such-like foods were to be given in such large quantities as to forbid of sufficient actual fattening food entering into the daily ration. So that the more rapidly the fattening is required, the more limited must be the quantity of this coarse foodstuff given, which may be reduced in intensive fattening to not more than 5 to 10 lb. per 1000 lb. live weight.

Growth and Fattening. The processes of growth and fattening are of extreme importance not only to the producer of fat stock, but also to the meat inspector, so that no excuse is needed for further summarising some of the leading features of these conditions. To produce a suitable carcase for meat, these two processes of growth and fattening have each to be successfully accomplished. Up to a certain point the two are combined, because the normal growth of an animal involves the production of a certain amount of fatty tissue. At the same time, however, growth itself does not necessarily include what is termed "fattening," because, as we have already seen, growth consists principally in the increase of the proteid elements of the body, and is manifested in the increase of muscle, bone, ligaments, and connective tissue. Fattening for the market is a more artificial process, and involves a more or less unnatural and rapid formation of adipose tissue. The extent to which this additional fat is deposited in home-fed fat stock is obvious to all who have had the opportunity of making a comparison between these animals and those slaughtered in an ordinary abattoir abroad.

There is, perhaps, nothing which strikes the observer more than what he would consider the poor quality of the beef animals in many of the markets abroad compared to those he is accustomed to seeing at home. As regards the relationship of the fattening process to the meat production, it must be regarded as essentially directed to improving the quality of the meat by the accumulation of fat in and between the muscle-fibres themselves, as well as involving the depositicn of considerable quantities of fat tissue in various parts of the body. Thus the two processes of growth and fattening, while being intimately associated in the natural process, are still essentially distinct from the point of view of the meat market, and indeed are frequently undertaken by different owners of the same cattle, the one being the grower, the other often buying for fattening.

Growth the Essential Factor. The growth of the animal itself must be regarded as the essential factor in the production of the meat, the fattening as an additional factor. The growth of the animal is determined principally by age, being most rapid in the earliest part of the life and decreasing in rapidity as maturity is approached. It is to be estimated in terms of the increase of the amount of proteid elements, which can be stated as a percentage composition of the total animal.

This increase of proteid—in other words, the essential growth—is highest in youth and gradually decreases. So that growth is synonymous with immaturity, using that word, not in the sense of the meat inspector, but in the ordinary biological significance.

One other peculiarity which marks a distinction between the process of growth and that of fattening remains to be noted, namely, that the rate at which it takes place is determined chiefly by the species and breed of the animal concerned; much more than by any variation in the food which is provided for that animal. In other words, the laws of growth are inherent in germ-plasm and are transmitted from generation to generation without variation, except when artificial cross-breeding is introduced. The average size of a given breed of animal maintained under similar environments remains the same. Even an extra supply of proteid elements in the food makes very little difference to the rate of growth or the ultimate limit attained. Very different, however, is it when we consider the process of fattening. This is principally dependent upon there being an excess of food assimilated over that required for the ordinary bodily functions, the balance being available for the storage of adipose tissue. Such a process may take place at any age of the animal if the food be in excess of the demand, but it will obviously follow that there will be more difficulty in producing a great degree of fatness in very young animals than in older ones, for the simple reason that in the young there is more demand upon food-supply for the ordinary purposes of growth and exercise, while as the animal gets older the needs of growth have been largely met and the muscular movements become somewhat less active.

Age an Important Consideration. The increase in the live weight of an animal, therefore, is composed of more proteins and water than of fat if the animal be young, while if the animal be older the fat ratio will increase and there will be relatively less protein than in an animal on a diet which is simply a growing one. It leads us to the consideration of the factor of age in the production of stock for meat purposes, because it involves the assumption that age is the most important of all considerations in this question. Animals gain *meat* most rapidly when young because, as we have seen, that is the period of the greatest rapidity of growth.

During that time they store up most protein as well as water, this being contained in the protein elements, and therefore at this period they increase most rapidly in weight. If a calculation were made to show the energy available per pound as estimated by "calories," it would be found that a pound of gain by animals fairly well matured contains in it nearly twice as much energy as does a similar amount in a young calf. When we come, however, to consider fattening, we are dealing with a process which is vastly more rapid, or may be, than is the process of growth, so that the ideal method would appear to be to take all steps to ensure the rapid growth of the animal in early youth, so that the process of fattening may be commenced as the rapidity of the growth declines, and yet sufficiently early to ensure that when actual growth has reached its normal limit fattening will also be as nearly as possible at the stage required. In that way the animal, directly it is full grown, will also be fattened and ready for sale. In all these considerations, and indeed in all matters connected with the raising of living animals for any purpose, there will always be exceptions to any rules, which can only be explained by saying that they are due to the individuality of the particular animal in question. Animals have their idiosyncrasies just as human beings have, and these are frequently manifested in the processes of growth and fattening ; thus some animals will grow more rapidly than others and mature more early. Others differ in the amount of food that they can assimilate with advantage.

One or two points in connection with the requirements of food in meat-producing animals may be added here. The younger the animal the greater necessity for protein elements, while in aged animals that necessity is small. According to Mr. W. H. Jordan, the protein of matured fattened animals has been greatly exaggerated in the past ; there is, he states, abundance of evidence to show that a protein-supply scarcely greater than that required for maintenance is sufficient for the matured fattening animals.

The Protein Requirements in Swine. In the case of swine the protein requirements are considerably greater than those for sheep, this being accounted for by the much more rapid growth of pigs. It has been repeatedly shown that deficiency in the protein elements of the food in young pigs is followed by the worst possible results, the muscles and bones being ill-developed and the carcase overloaded with fat.

Fat or adipose tissue is regarded by Ostertag and Grawitz as a modification of connective tissue, mostly fibre and bone-marrow, it being the object in the fattening of animals to bring about this change.

The stage at which this fattening is at any given moment is the indication of the fitness or otherwise of the animal for slaughter. Moreover, the presence or absence of the fat is a very important factor in the judgment of the meat inspector as to the fitness of the carcase. We have on another page considered this point in relation to poorness and emaciation. During the process of fattening the adipose tissue itself develops in excess in certain definite situations which are known as the fat depositories, these including especially the following :

The fat capsule of the kidney.
The mesenteries.
The omentum.
The subcutaneous tissues.
The retro-peritoneal tissues.
The inter-muscular tissue.
The liver.
The bone-marrow.

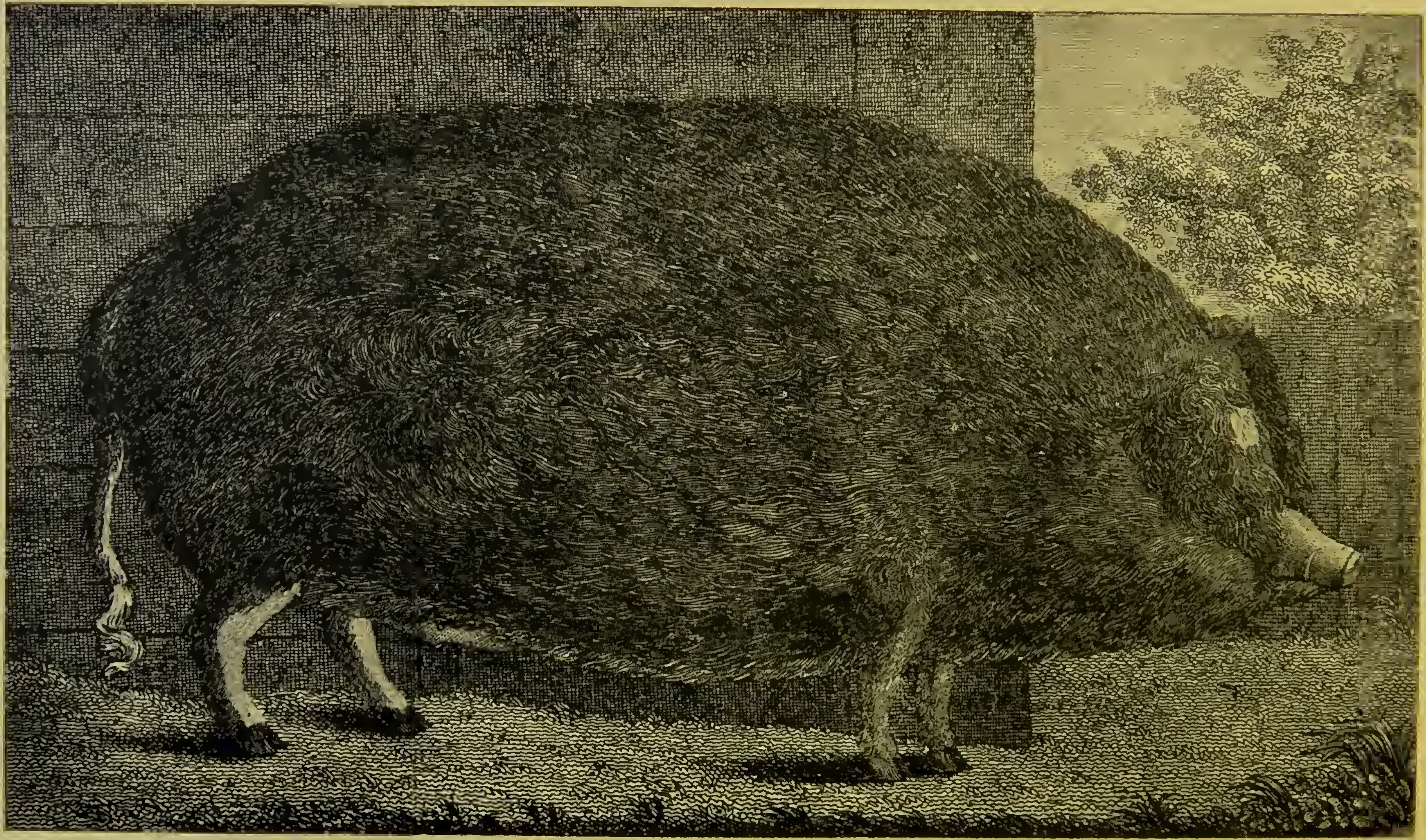
Three Classes of Animals. By taking these localities and comparing the extent and amount of adipose tissue deposited in them, it is possible to classify animals into poor, fattening and fattened carcases. In this way a poor carcase would be regarded as one in which the fat was present only in the region of the kidney and between the mesentery and omentum. In an animal which was fattening this tissue would be found in the subcutaneous parts right up to the back, and extending also from the shoulder-girdle to the rump. In a more advanced stage of fattening the adipose tissue in the superficial parts of the body is greater in amount and thickness, and is more obvious in the situations above-mentioned. When fattening has reached the stage required for the best quality of meat, the adipose tissue distends the capsule of the kidney completely. In the abdominal cavity the mesenteric glands are covered with a deposit of fat, and the layers of the mesentery are separated by this fat deposit in which the glands lie. The omentum, instead of being an extremely thin membrane, becomes a large mass of fat of varying thickness, while the subcutaneous tissue all over the body is filled with a similar deposit.

Looking at the carcase, this presence of accumulated fat is well marked on both sides of the vertebral column, and if such a carcase be compared with that of a poor animal or an emaciated one, it will be at once seen where the fattening process is most obvious. Thus in the fat animal there will be no bony crevices visible, and it will be difficult even to feel them, and all hollows and depressions and concavities visible in the emaciated carcase are filled out to the level of the rest of the body.

What is the Fatty Cell ? If the connective tissue between the muscle-fibres be examined it will be found that there is a deposit of fat arranged in lines parallel to the fibres themselves, and it is this deposit in particular which, in all probability, extends to the best quality of meat, which is particularly good-flavoured.

Not only, however, may this fat be found between the fibres, but there may even be an accumulation of it within the fibres themselves, that addition known to pathologists as fatty infiltration.

Grawitz, however, who has investigated the histological changes in the fattening process, regards the fatty cell as a colony made up of a number of flattened, round or spindle-shaped cells, which become united with the membrane of the growing fat-cell. During fattening the bone-marrow is transformed into fat, and in the muscles there is no invasion of fat between the muscle-fibres causing them to disappear, but the fat of red meat is really muscle-tissue which has lost its nucleus, and, like connective tissue and bone-matter, has become modified into the form and appearance of ordinary adipose tissue.



THE ORIGINAL SCOTTISH PIG (1814)

According to various authorities, the original Scottish pig was of a very unprofitable type. It presented the appearance of the wild boar and took a long time to fatten.

CHAPTER V

SWINE HUSBANDRY

THE BREEDS OF PIGS

THE early history of swine shows that, in primitive times, pig products were valued as a substantial portion of the diet of the people, owing to the fact that swine are able, to a large extent, at least at some seasons of the year, to find food for themselves in the forests. They were regarded by our ancestors as being their principal source of flesh-food. This was particularly so in the United Kingdom, and it has been shown by Paladius, a monk who wrote of English husbandry about the year 1420, that swine-breeding was then one of the resources of the primitive agriculturist. He gives sage advice as to the time when the breeding should take place, but, as he states that the sow breeds from her second year, it is quite evident that the race of pigs which existed then is different from what it is now.

Later writers, such as Thomas Tusser in his " Four Hundred Points of Good Husbandry," which was written in 1573 ; Fitzherbert in his " Four Books on Husbandry," written in 1523 ; Gervaise Markham, who wrote " The Country Farm " in 1616 ; Leonard Mascal, who wrote his " Countryman's Duel " in 1662 ; and Edward Lisle, in his " Observations in Husbandry," 1795—all deal at very considerable length with the pig on the farm, and they all unite in stating that the pig under domestication is an animal which thrives best with cleanly conditions. The necessity for cleanliness is insisted upon by these old writers, and this illustrates the fact that the immediate progenitor of the domestic pig, namely, the wild boar, is one of the cleanest animals of the forest. It is a curious thing, therefore, that there should be an impression abroad in modern times that the pig is necessarily an animal which thrives best in filthy surroundings.

The Wild Boar of the Forest. In more recent times than those to which we have referred, Robert Henderson, a Scottish farmer who flourished near Annan about the beginning of the nineteenth century, wrote a treatise on the breeding of swine and the curing of bacon, and this work may be regarded as being the first complete book devoted entirely to this subject. Henderson states that the wild boar was formerly a native of Great Britain, and that the vast forest that grew on the north side of London was the retreat of many fallow-deer, wild boars, and bulls. The Caledonian Forest, supposed to be the Ettrick Forest, was anciently the retreat of the Caledonian boars, which were remarkable for their fierceness, and which are now nowhere to be met with in Great Britain. Inglewood Forest, between Carlisle and Penrith, was once the retreat of the wild boar, which during the day remained in the most sequestered part of the wood, and came out at night in quest of food.

He goes on to state that in the Highlands of Scotland large flocks of swine have been kept and reared in the glens in the same manner as the horse, cattle, and sheep. About forty-five years previous to the time his book was published, which was in 1811, large droves of Highland swine were brought into Annandale and sold to the farmers, who bought them more from motives of curiosity than from profit. They were said to be very small, with long bristles on their backs, and were sold when one year old and upwards for 4*s*. or 5*s*. per head. According to the same author, large herds of swine were kept in the county of Northumberland, and jobbers from Dumfriesshire, in Scotland, purchased great numbers of them after harvest, and brought them north, where they found a ready market for them. Yorkshire also was a celebrated county then for pig-breeding, and it was common at that time to see a person attending thirty, forty, or fifty swine upon clover- or stubble-fields. In the county of Norfolk the swine were not so large a breed, and they were not generally used for bacon purposes but more for pork, and, according to Henderson, "the intelligent farmers there say that if it were not for their swine, they could neither feed their families nor pay their rents."

Differences in the Breeds of Swine. As showing the differences which exist between the breeds of swine that were in existence in the United Kingdom then and now, we may quote what Henderson says on this subject:

"The Chinese, or black breed, are now common in Britain. They have short legs, are smaller, and their flesh whiter than the common kind. It is said this species are found in Guinea, and that they are very numerous in the Friendly, Society, and many of the other newly discovered islands in the South Sea. The real Highland hog is well adapted to the climate where it is found; it is well shaped, the bone small and the ham plump, and, when well fed, is delicious eating. A cross between them and the Chinese breed, I apprehend, would answer well, as this would increase the weight of the Highland hog and add to the hardiness of the Chinese, and be the means of lessening the bone of the latter; a heavy carcase upon a small bone is the most proper animal for feeding, and this sort would be fattened with little food.

"There is a species of swine in Ross-shire, mostly black-spotted and of a very plump make, which seem to be easily fattened and get early to a proper size for porking. It is much superior to that diminutive creature that is so common in Fifeshire and the Lothians, which is neither easily fattened nor ever arrives to any considerable weight. It seems to be a town talk when a hog-pig of the latter species weighs eight stone Dutch; perhaps an old sow may chance to arrive at fourteen or sixteen stone. The breeders in these countries must eradicate such a mongrel kind before they can do any good by keeping swine."

Pigs in Various Counties. " I have lately seen hogs of a black colour at the Earl of Moray's, at Dennibirsel, that have close feet like a horse, instead of being cloven-footed ; but they seem to have nothing else particular about them to recommend them beyond other swine in that neighbourhood. The conveniencies in which they are kept are extensive but of a bad construction, not being of modern contrivance. These erections might be very much improved at a small expense, as there are materials upon the spot.

" From Dunbar to Berwick the swine seem to be of a better sort and will weigh more, but that may be owing to their superiority in feeding, as the practice of killing pork for the London market is carried on at Berwick with great spirit.

" In Northumberland they have a kind of black-spotted swine, not very large, which makes good bacon and pork ; they are not a pure breed, but rather of a mongrel kind.

" The Cumberland breed are generally large and mostly of a white colour ; many of them would feed from 25 to 30 stone when fourteen or eighteen months old. They are strong-boned, with large ears hanging down over their eyes so far as their snout. In that county families live much upon bacon, and it is very common to see three or four of these heavy swine hanging in a kitchen for family use. Almost every farmer keeps one or two breeding-sows ; they pay great attention to feeding them properly, and sell their sucking-pigs at market towns when from six to eight weeks old ; they are generally very large and fat, and will sell at from 12*s.* to 20*s.* each. It is common with them to give their pigs new milk from the cow twice a day the last three weeks they are upon the sow, as they then get strong and their dam cannot support them, at least to make so fat as they are generally shown in the market."

Preparing the Animals for Market. " There will be about 120 pigs sold in Carlisle market every Saturday through the season. Most of them are bought by Dumfries jobbers, and taken to Dumfries market in carts on the Wednesday, where they are sold to the Galloway farmers for feeding. So foolish are the cottagers on the borders of Scotland that they always purchase the largest pig they can get. I am certain it would be more for their interest to purchase pigs of a smaller breed, as the large swine require much more food.

" In Westmorland their swine are not of so large a breed, this district not being so much of a corn country ; they are, however, carefully fed and reared to a good weight.

" In Lancashire they keep a good sizable swine, which is mostly black and white spotted ; they feed to about twenty stone. In this county they feed mostly with beans and other substantial food, and their pork is very firm. I have known them feed to such a degree that the animal could scarce eat anything ; they would bake the oatmeal into little balls and when it began to loathe that feeding, give it new milk from the cow, often making it so fat that it could not rise. They manufacture very little into bacon, being mostly all sold in the market by the feeder: in sides and quarters—for people to cure and dry for family use."

The Good Example of Cheshire. "In Cheshire they keep a very proper sort of pigs; they are generally black-spotted, with pretty large ears, which bend forward but do not hang so straight down as in the Cumberland hog, with short legs and broad back. Here they feed to great perfection and pay the utmost attention to the animal; they are as regular in the cleaning and feeding of their hogs as with their horses. Cheshire being a great cheese county, they have plenty of whey and other offals from the farm, which they keep carefully for their pigs. These hogs seem less adulterated than those in Scotland, every one being very much like another. They generally weigh from 20 to 25 stone.

"I would recommend it to some of the principal cheese-makers in the west of Scotland, particularly in Ayrshire, to make a tour through part of England and pay attention to the management of swine in Cheshire. They would then know the value of whey, and how to use it; their pains and expense would not be lost, as the cheesing districts in Ayrshire are as well calculated for keeping pigs as Cheshire.

"Great numbers of pigs are fed in North Wales. I once happened to be at Mold Fair, in Flintshire, where there might be 500 fat swine shown for sale. Jobbers and butchers from Manchester and its neighbourhood purchased large droves of them, and they were all sold off; the average weight might be 14 stone. They were all of a white colour. I was very much pleased to see so many plump, well-fed animals, all so much alike that one would have imagined they were all from one sow. Most of them were fed in Denbighshire and Carnarvonshire. In South Wales also many swine are kept, but I never had an opportunity of viewing them. But it is needless to mention a county here and there, for over all England and Wales swine are kept in large flocks, and are found of the greatest benefit to the community at large."

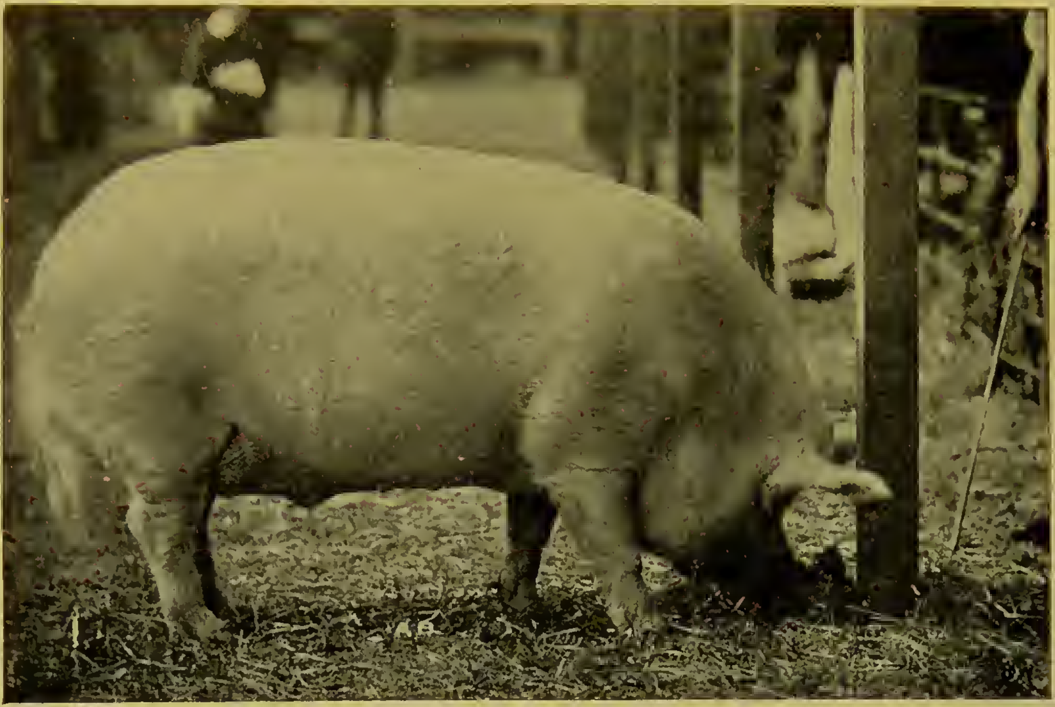
The Berkshire Hog. "Of all the sorts of hogs I have seen, however, and that is not a few, I would give the preference to the Cheshire, or rather the Berkshire hog; this kind will grow to a good size, is easily fed, small-boned and of a handsome make. Many of them are of a singular reddish colour, and I have seen droves of them that when the sun shone on them appeared of the colour of gold. I wish very much to see them introduced into Scotland, and am certain they would be more profitable than any other species.

"Many of our gentlemen put their money to a worse use than if they were to send a careful person, who has a knowledge of swine, to bring a small drove of sows and a few boars of the true Berkshire breed. They can be got in Cheshire, or the neighbouring county, without going so far as Berkshire. Indeed it would not be spending their money without reward, for they would be amply repaid for their trouble, besides doing an infinite benefit to the community. If ever the pork trade takes place in Fifeshire, or in the Lothians, the breed ought to be changed, as the present stock is entirely out of the question. The journey may be thought long for the purpose of bringing swine, but time and perseverance will accomplish it, and the example must be set by some individuals introducing a proper stock, before the prejudices naturally operating against any new plan can be removed. It would be a good scheme for a number of farmers to join in sending a man to purchase a sufficient number of sows and boars. If anything of the kind takes place, on application being made to the author at Leven, in Fifeshire, he will furnish them with a person fully able to execute the business, besides becoming one of the subscribers himself. The month of August would be the fittest time for this species of stock travelling."

Truffle-hunting by the Aid of a Pig

The Coming of the Chinese Hog. The Chinese hog seems to have been introduced into the United Kingdom about the end of the eighteenth century, as it is for the first time described by John Mills, who wrote in 1776 " A Treatise on Cattle," and he incidentally speaks of the Chinese pig as one which differs from those in Europe " in that they are smaller, their legs considerably shorter, and their flesh much whiter and more tender." The Berkshire breed which has been already referred to was regarded as being the principal swine-stock in the country, and according to a modern author * the value of the Chinese pig for cross-breeding was then recognised : " In Ryedale, in the North Riding of Yorkshire, it was gaining ground ; in Kent the smaller sorts were mixed with the

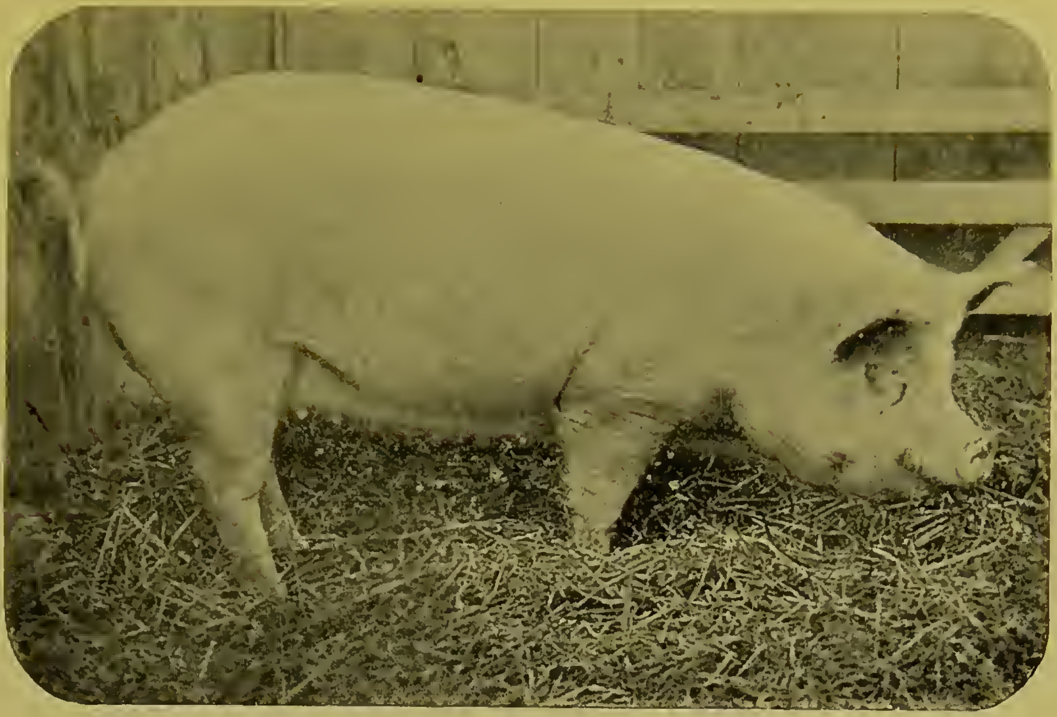
* "Pigs in Health." By Sir Walter Gilbey, Bart.



Large White Yorkshire Boar

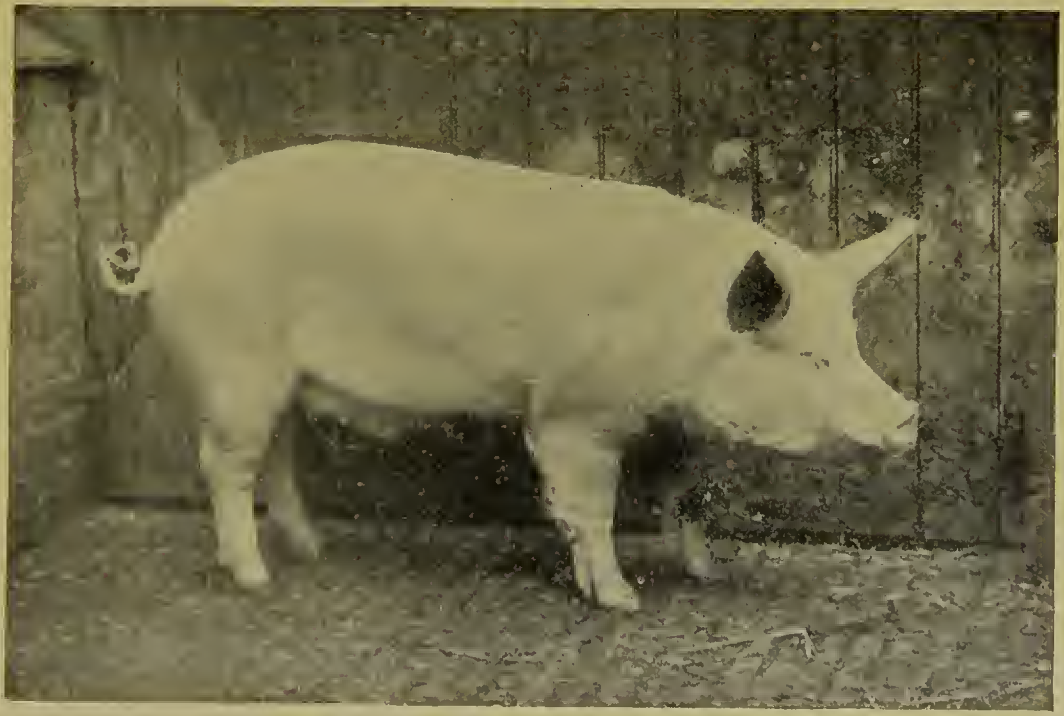
Chinese ; in Lancashire at least one breeder used Chinese blood ; and in North Wales it had been used for a long time to produce from the varieties any proof of the esteem in which it was held. It may be said that at a meeting of the Bath and West of England Society in 1802, a prize of £5 5*s*. was given for an excellent boar of Chinese admixture and £3 3*s*. for a pig of Chinese admixture."

Group of Large White Yorkshire Pigs



Young Large White Yorkshire Sow

The early races of pigs, therefore, seem to have been a mixed lot, and more especially in Hertfordshire, Buckinghamshire, and Hampshire, where there was no attempt made at selection at all, but where great herds of swine were kept in the forests, and it was not until later times that the process of selection began.



Young Large White Yorkshire Boar

Changes in Breed. Swine are distributed pretty well all over the world and more especially in Europe; they have been subjected to much study and selection, and during the last hundred years the process of elimination has been proceeding in all civilised countries. Fixed types of swine have been perfected in Europe and America, with the consequence that there are great dissimilarities in the conformation of various breeds at the present day. Generally speaking, it would be correct to say that the ancient breeds of swine have been so modified as to lessen, to a very material extent, the quantity of bone present, and to increase the percentage of flesh, but it would be difficult to determine, even if it were worth while, when this process of elimination began; suffice it to say that at the present day the principal factor in the production of swine is the kind of pig required by bacon-curers, and the various races which are recognised as being pure breeds are cultivated principally with this end in view, namely—the supply of bacon.

It is a remarkable thing that, notwithstanding the great development in pig-breeding in other countries, the principal stocks originated in the United Kingdom and have been developed or modified in various pig-breeding countries. The types, therefore, which we have in the United Kingdom may be taken as the parent stock of the principal pig races throughout the world. The principal breeds recognised in the United Kingdom at the present day are:

The large white Yorkshire,
The middle white Yorkshire,
The Tamworth,
The Berkshire,
The large black pig,
The Lincolnshire curly coated pig,

and all of these have different characteristics.

The Large White Yorkshire. The large white Yorkshire pig of the present day was known in the north of England at the beginning of the eighteenth century, and at that time was narrow in the body, coarse in the bone, had large ears and was an unprofitable feeder. About 1760, however, Robert Bakewell, who was a noted agriculturist, proceeded to take an interest in this particular breed of swine, with the result that he selected the smaller animals and noticed that they had a greater aptitude for putting on flesh than the large coarser ones. From that time until the present day there has been a steady increase in the number of farmers breeding Yorkshire swine, but about 1860 it became quite evident that the large breed was not eliminated, as had been thought at the time when Robert Bakewell began his experiments, and it appeared that there were two kinds of Yorkshire swine in different parts of the country, which were subsequently classified as the Large and Middle White Yorkshire breeds. Subsequently a third kind was added to the breeds in the shape of the small whites, but this race has become smaller and smaller and for our present purposes may be entirely neglected. The feature of the Yorkshire pigs is that they fatten quickly and provide that quality of meat which bacon-curers demand. The large white Yorkshire breed provides that long, deep side which is so much wanted for singed bacon purposes, whereas the middle whites are unequalled for the production of hams. Under good conditions Yorkshire pigs will mature in six to seven months, and at that age, if they have been properly fed, will weigh between 180 and 220 lb.

The following are the standards of excellence of the three breeds of Yorkshire pigs, as recognised by the Yorkshire Pig Breeders' Association of the United Kingdom.

LARGE WHITE

Colour. White, free from black hairs and, as far as possible, from blue spots on the skin.

Head. Moderately long, face slightly dished, snout broad, not too much turned up, jowl not too heavy, wide between ears.

Ears. Long, thin, slightly inclined forward and fringed with fine hair.

Neck. Long and proportionately full to the shoulders.

Chest. Wide and deep.

Shoulders. Level across the top, not too wide, free from coarseness.

Legs. Straight and well set, level with the outside of the body, with flat bone.

Pasterns. Short and springy.

Feet. Strong, even and wide.

Back. Long, level, and wide from neck to rump.

Loin. Broad.

Tail. Set high, stout and long, but not coarse, with tassel of fine hair.

Sides. Deep.

Ribs. Well sprung.

Belly. Full but not flabby, with straight under-line.

Flank. Thick and well let down.

Quarters. Long and wide.

Hams. Broad, full, and deep to hocks.

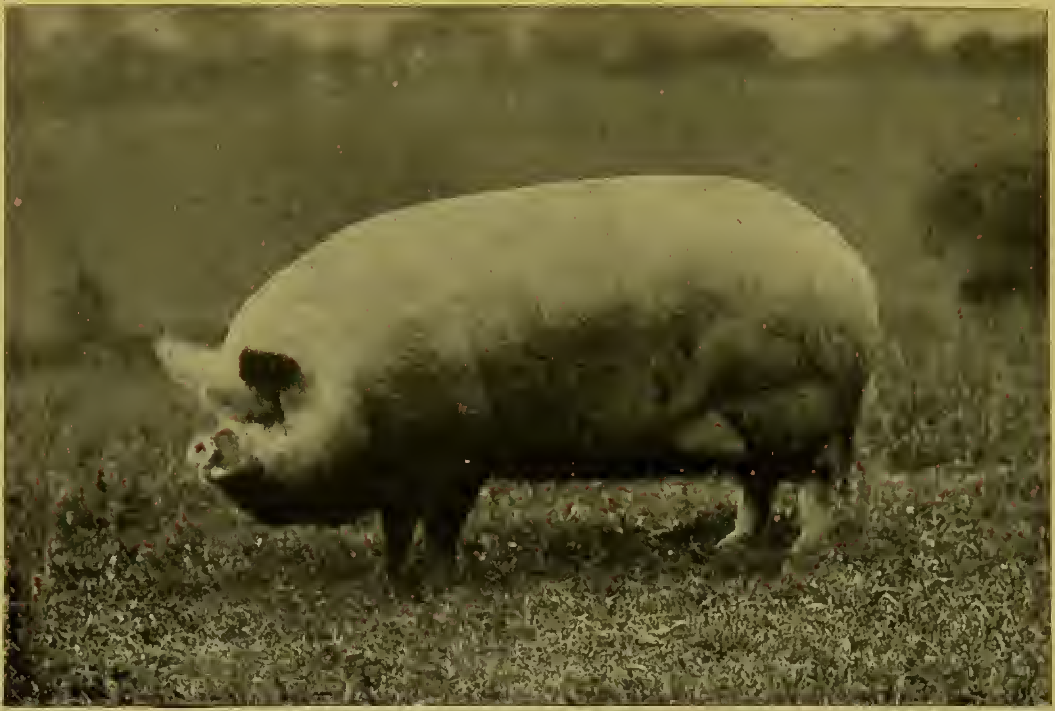
Coat. Long and moderately fine.

Action. Firm and free.

Skin. Not too thick, quite free from wrinkles.

Large bred pigs do not fully develop their points until some months old, the pig at five months often proving at a year or fifteen months a much better animal than could be anticipated at the earlier age and *vice versa ;* but size and quality are most important.

Objections. Black hairs, black spots, a curly coat, a coarse mane, short snout, inbent knees, hollowness at back of shoulders.

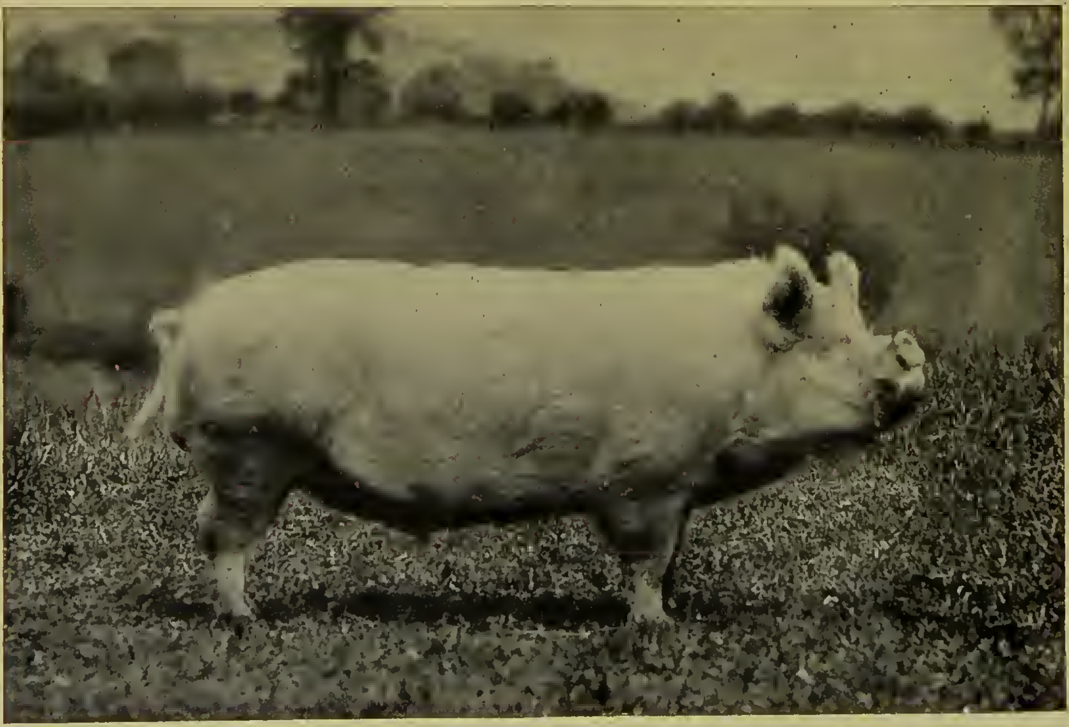


Middle White Yorkshire Sow

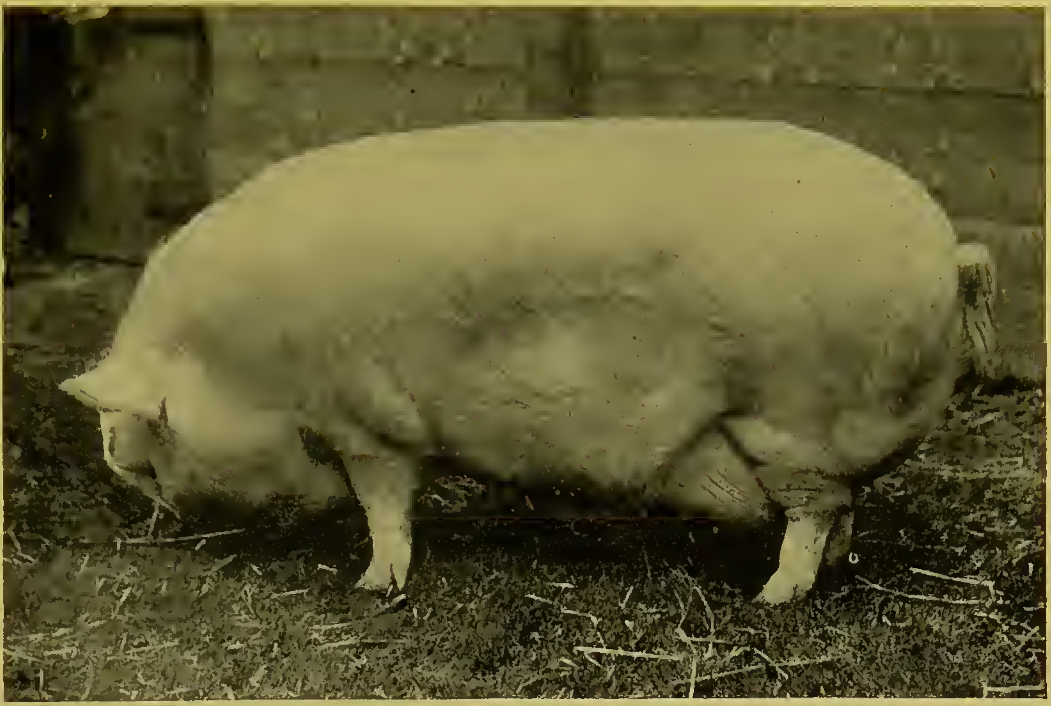
Middle White

Colour. White, free from black hairs or blue spots on the skin.

Head. Moderately short, face dished, snout broad and turned up, jowl full, wide between ears.



Middle White Yorkshire Boar



Middle White Yorkshire Sow

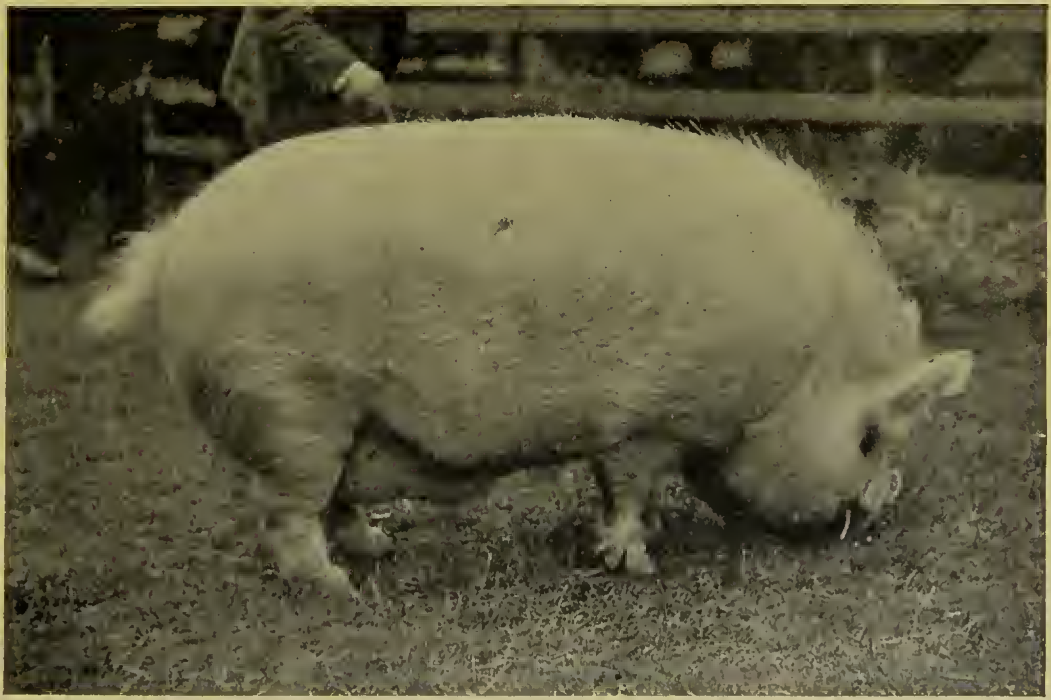
Ears. Fairly large, carried erect, and fringed with fine hair.

Neck. Medium length, proportionately full to the shoulders.

Chest. Wide and deep.

Shoulders. Level, across the top moderately wide, free from coarseness.

Legs. Straight and well set, level with the outside of body, with fine bone.



Small White Yorkshire Boar

Pasterns. Short and springy.

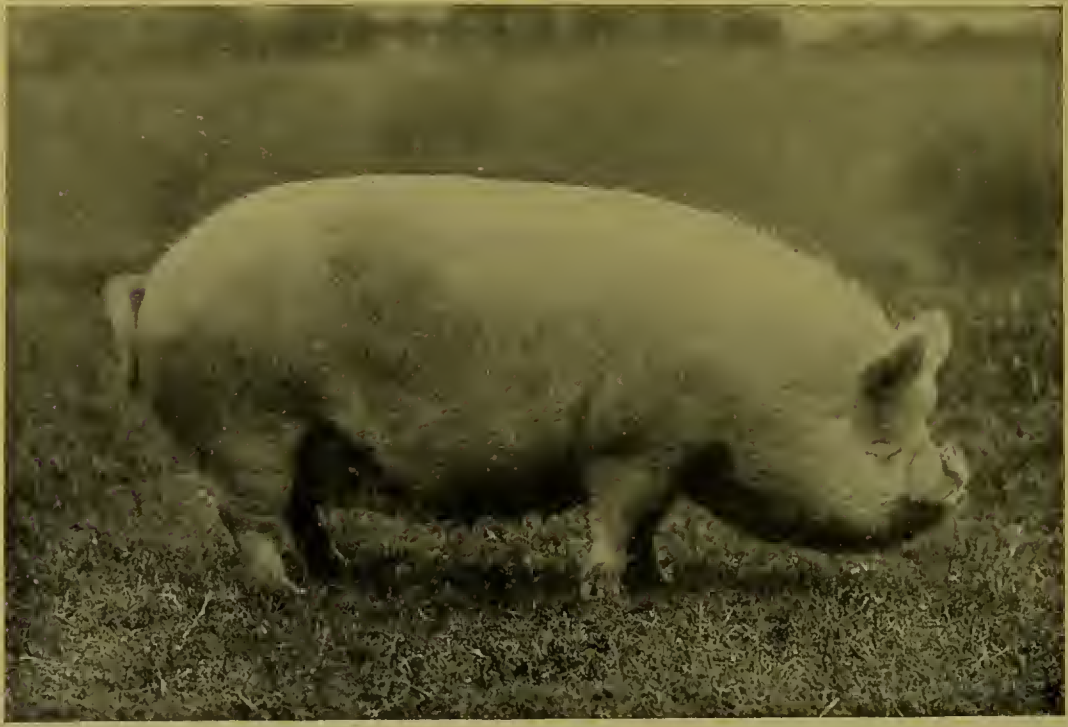
Feet. Strong, even and wide.

Back. Long, level, and wide form neck to rump.

Loin. Broad.

Tail. Set high, moderately long, but not coarse, with tassel of fine hair.

Sides. Deep.



Small White Yorkshire Sow

Ribs. Well sprung.

Belly. Full, but not flabby, with straight under-line.

Flank. Thick and well let down.

Quarters. Long and wide.

Hams. Broad, full and deep to hocks.

Coat. Long, fine, and silky.

Action. Firm and free.

Skin. Fine, and quite free from wrinkles.

Objections. Black hairs, black or blue spots, a coarse mane, inbent knees, hollowness at back of shoulders, wrinkled skin.

Small White

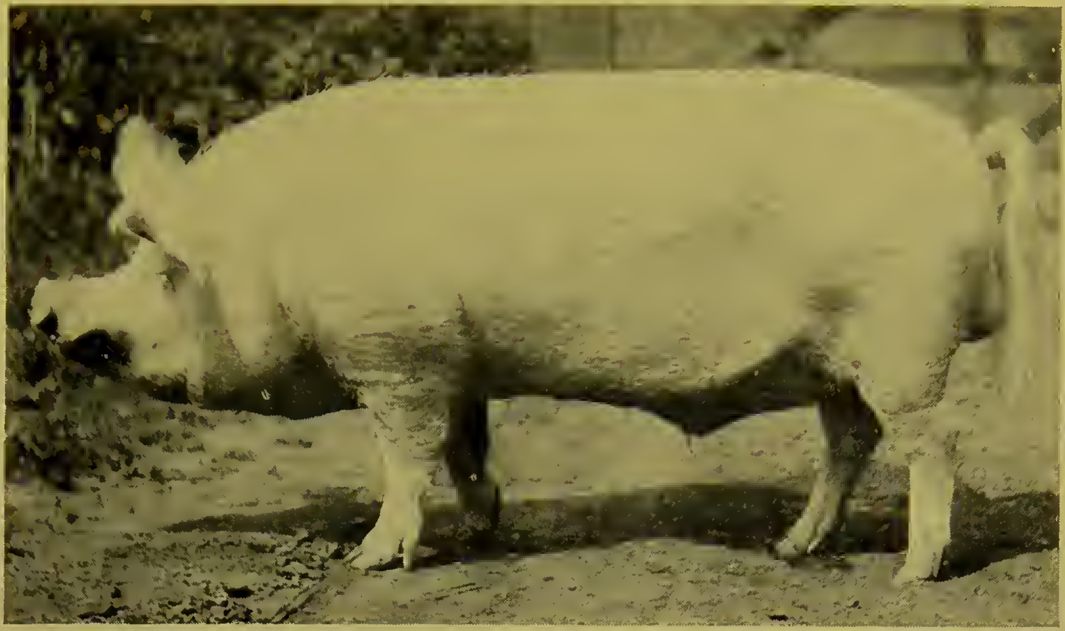
Colour. Pure white.

Head. Very short and dished, snout broad and turned up, jowl very full, and broad between ears.

Ears. Small, short and erect.

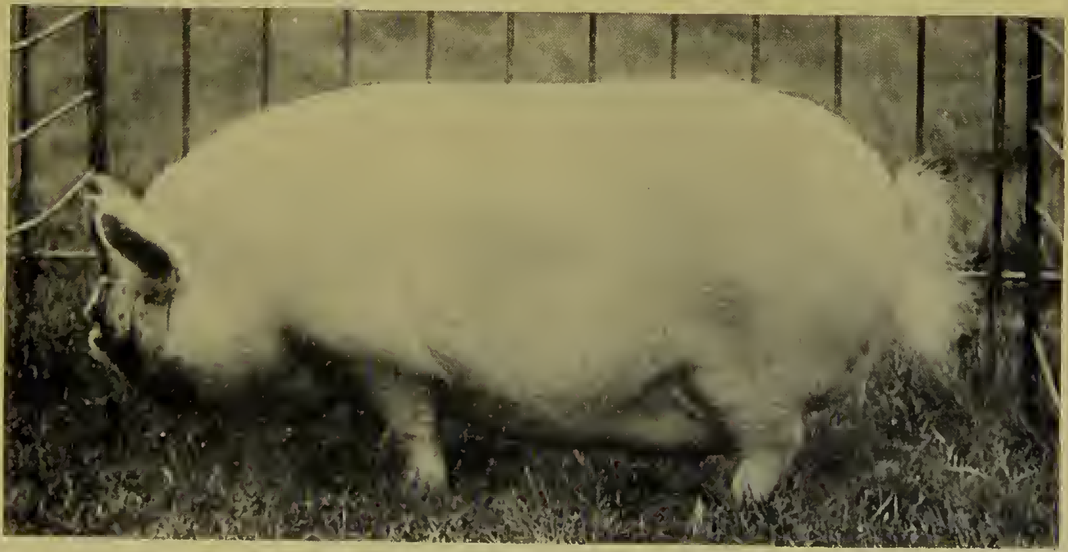
Neck. Short and thick.

Chest. Full and broad.



Champion Large White Boar

Shoulders. Full and wide.
Legs. Short, set well outside the body, fine bone.
Pasterns. Short and springy.
Feet. Small.
Back. Broad, level, and straight.
Loin. Wide.
Tail. High set, small, and fine, with tassel of fine hair.
Sides. Deep.
Ribs. Well sprung.
Belly. Deep, and near ground.
Flank. Thick, and well let down.
Quarters. Wide and full.



Prize Middle White Sow

Hams. Deep, wide, full, and well-rounded.

Coat. Fine and silky.

Action. Firm and free.

Skin. Fine, quite free from wrinkles.

Remarks. The general appearance of animal—small, thick, and compact when compared with other breeds.

Objections. Black hairs, black or blue spots, coarse hair, inbent knees, hollowness at back of shoulders, wrinkled skin.

Tamworth. Next in importance to the Yorkshire breed of pigs comes the Tamworth, which has quite a different appearance from any of the white breeds. It is said to have been introduced into England from Ireland by Sir Robert Peel in 1715, but it is also stated that it was quite well known in the Midlands of England previous to that date.

The Tamworth pig has a dark red colour, is somewhat lengthy in the limb and flat in the ribs. Their principal characteristic is that they produce lean flesh, and it is on this account that they are largely used for crossing with the Yorkshire breed and also with Berkshires.

The Tamworth pig matures to bacon weights in about seven months.

The following is the standard of excellence recognised by the N.P.B.A.:

TAMWORTH

Colour. Golden red hair on a flesh-coloured skin, free from black.

Head. Fairly long, snout moderately long and quite straight, face slightly dished, wide between ears.

Ears. Rather large, with fine fringe, carried rigid and inclined slightly forward.

Neck. Fairly long and muscular, especially in boar.

Chest. Wide and deep.

Shoulders. Fine, slanting, and well set.

Legs. Strong and shapely, with plenty of bone and set well outside body.

Pasterns. Strong and sloping.

Feet. Strong, and of fair size.

Back. Long and straight.

Loin. Strong and broad.

Tail. Set on high and well tasselled.

Sides. Long and deep.

Ribs. Well sprung and extending well up to flank.

Belly. Deep, with straight under-line.

Flank. Full and well let down.

Quarters. Long, wide, and straight from hip to tail.

Hams. Broad and full, well let down to hocks.

Coat. Abundant, long, straight and fine.

Action. Firm and free.

Objections. Black hair, very light or ginger hair, curly coat, coarse

TAMWORTH BOAR

mane, black spots on skin, slouch or drooping ears, short or turned-up snout, heavy shoulders, wrinkled skin, inbent knees, hollowness at back of shoulders.

Berkshire. The Berkshire has played a not inconsiderable part in the bacon industry of the United Kingdom, as it has been principally bred in the southern counties, and in that way has come to be largely used for bacon purposes. At one time it was a large ungainly animal, but at the beginning of the nineteenth century it was bred down to its

PRIZE TAMWORTH BOAR

present proportions, and at the present day the type is well known and recognised. The colour of the Berkshire is black, but it is frequently intermingled with other colours, due to the crossing with different breeds. Pure-bred Berkshires, however, are not recognised unless they are black with white on the face, feet, and tip of tail.

In 1862 the Royal Agricultural Society of England made a special class with Berkshires and, since that time, this breed has steadily grown in favour owing to the fact that they are very hardy and are short in the fore part of the carcase, so that there is comparatively little waste of meat. The particular features which characterise the breed are that the face is usually short, the snout is turned up and the jowl heavy; the shoulders are massive and the back is broad, so that the proportion of lean meat to fat is as perfectly developed as in any other breed.

Berkshire Sow

The points of excellence recognised by the British Berkshire Society are as follow:

Berkshire

Colour. Black, with white on face, feet and tip of tail.

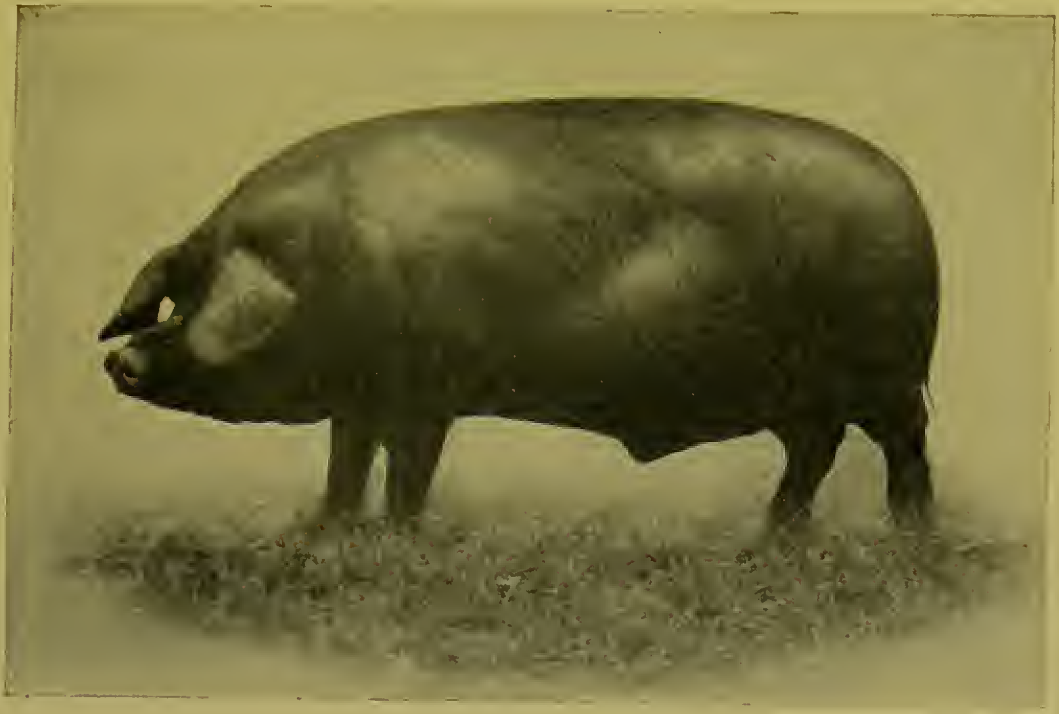
Skin. Fine and free from wrinkles.

Hair. Long, fine, and plentiful.

Head. Moderately short, face dished, snout broad and wide between the eyes and ears.

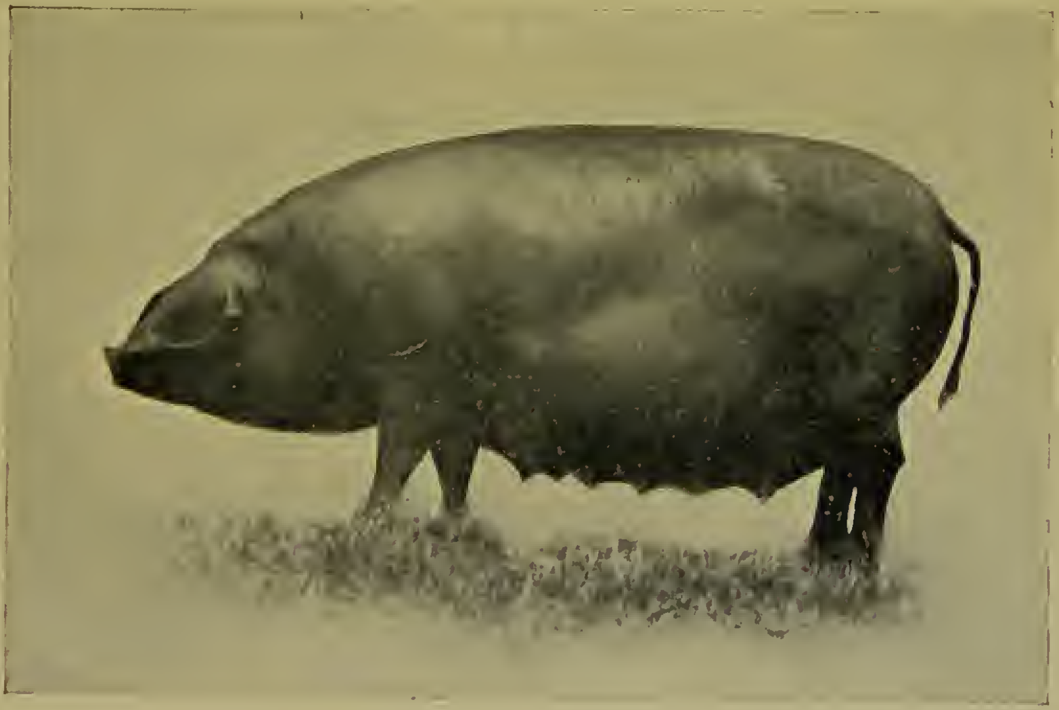
Ears. Fairly large, carried erect or slightly inclined forward and fringed with fine hair.

Neck. Medium length, evenly set on shoulders; jowl full and not heavy.



Large Black Sussex Boar

Shoulders. Fine and well sloped backwards, free from coarseness.
Back. Long and straight, ribs well sprung, sides deep.
Hams. Wide and deep to hocks.
Tail. Set high, and fairly large.
Flank. Thick and well let down, making straight under-line.



Large Black Sussex Sow

Legs and Feet. Short, straight, and strong, not wide apart, and hoofs nearly erect.

Objections. A perfectly black face, foot, or tail; a rose back, white or sandy spots on the body, a white ear, a very coarse mane, or in-bent knees.

The Large Black Pig. The large black pig is a comparatively recent innovation, and this may be gathered from the fact that the Large Black Breed Society was only established in 1899, and since that time a good deal of controversy has taken place amongst bacon-curers as to whether the breed is suitable for bacon-curing purposes or not. It has been maintained that the large black breed is as rapid a feeder as any other, and the exponents of the breed proclaim that it is specially notable for early maturing. It is also said that the large black breed, on the average, produces more lean to fat than other breeds.

The points of excellence recognised by the Large Black Breed Society are as follow:

LARGE BLACK

		Points.
Head	Medium length and wide between the ears	5
Ears	Long, thin, and inclined well over the face	6
Jowl	Medium size	3
Neck	Fairly long and muscular	3
Chest	Wide and deep	3
Shoulders	Oblique, with narrow plate	6
Back	Long and level (rising a little to centre of back not objected to)	12
Sides	Very deep	10
Ribs	Well sprung	5
Loin	Broad	5
Quarters	Long, wide, and not drooping	8
Hams	Large and well filled to hocks	10
Tail	Set high, and not coarse	3
Legs	Short and straight	5
Belly and Flank	Thick and well filled	8
Skin	Fine and soft	4
Coat	Moderate quantity of straight silky hair	4
	Total	100

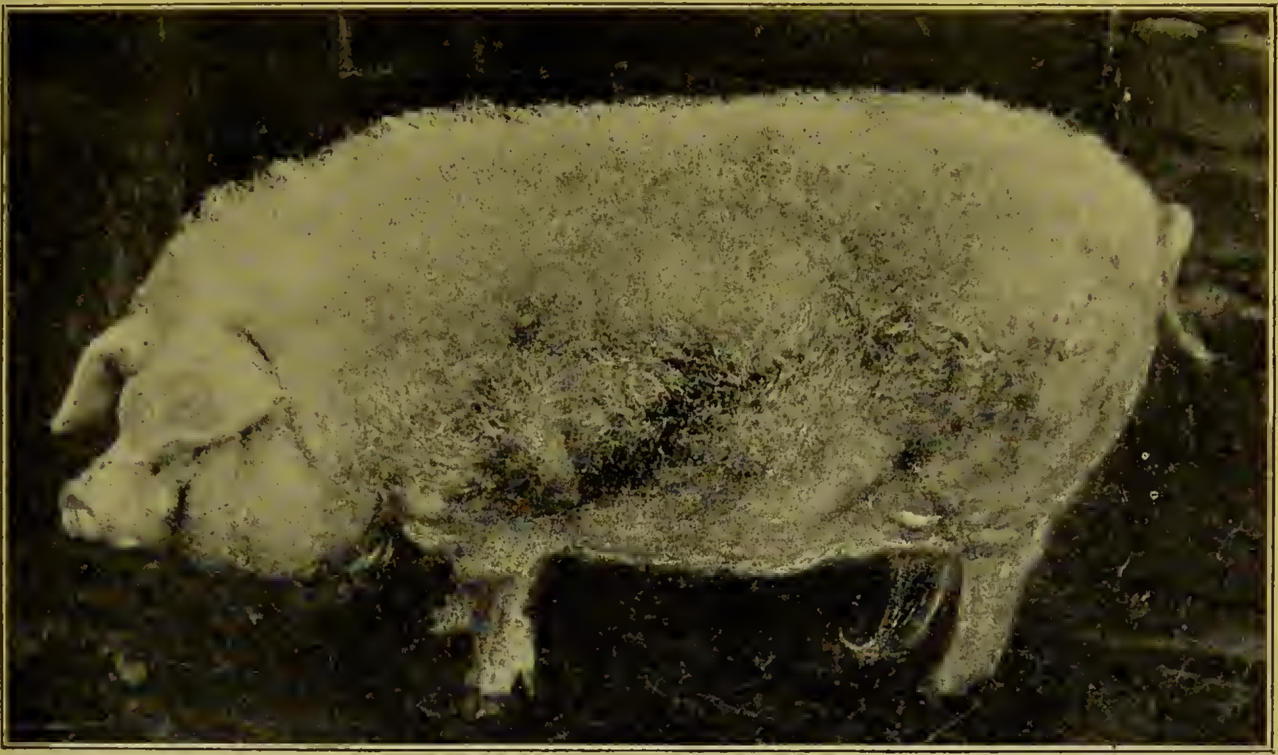
Disqualification

Colour.—Any other colour than black is a disqualification.

Objections

Head. Narrow head or "dished nose."
Ears. Thick, coarse or pricked.
Coat. Coarse or curly; bristly mane.

The Lincolnshire Curly Coated Pig. The Lincolnshire curly coated pig is not by any means a new arrival, but is one of these local breeds which have been suddenly forced into prominence by breeders in the county of Lincolnshire, who have found that this particular breed presents many features which would render it one of the best for bacon-curing. A description of the breed is given in a publication by the Lincolnshire Curly Coated Pig Breeders' Association, in which it is stated that until quite recently the breeders of Lincolnshire curly coated pigs made no effort whatever to secure for themselves a share of that demand that exists for all classes of British stud stock, other than that which they secured in their own immediate locality—the breed being exhibited for the first time at Smithfield in 1908, when this club kindly instituted one class and granted prizes.



LINCOLNSHIRE CURLY COATED SOW

Those who have been breeders of these pigs were fully satisfied as to their merits and capabilities, for the breed has been maintained and kept amongst the Lincolnshire farmers for generations, but, as mentioned before, no effort was made to test the breed in open competition with other breeds, nor to secure any share of the outside and export demand.

Since the incorporation of the Lincolnshire Curly Coated Pig Breeders' Association, definite steps have been taken to direct attention to the merits of this breed, and its claim to being one which matures rapidly, either as porker or bacon pigs, and gives an average daily gain well in excess of any other breed.

As a test of its capabilities in this direction, Mr. W. W. Chapman has compiled, on behalf of the Association, from his individual daily gain record of Smithfield Show, a table from which it will be seen that the breed not only makes the highest daily gain of any pig that has been weighed at Smithfield since the arrival weight of pigs was taken at that show, but it has also secured the highest average daily gain of a whole class, and also the highest individual average daily gain realised in the single pig class, for any white breed not exceeding twelve months of age.

It would have been fully justified if it had been decided to rest upon the notable success at the 1908 Smithfield Show, when the records mentioned were made, but a bolder course has been adopted, and one that proves the confidence of the breeders of this breed in being able to substantiate the claims they make on its behalf, as a breed of pigs unequalled in their maturity and development. It was resolved that in order to test these claims in the strongest possible manner, a tabulated table should be compiled, so that the data for comparison should not be limited to that of a single year, but to the whole of the pigs that have been weighed since the Smithfield Club first commenced to do so.

The result of this comparison shows that out of the 1059 pigs exhibited and weighed at Smithfield, the Lincolnshire curly coated pig has made the highest average daily gain of any single pig of any breed, and that its class average is higher than the class average realised by any other breed.

These facts confirm the claim that it makes, and are particularly valuable in showing to breeders, in other countries as well as in our own, that the place of this hardy, vigorous, sound, and prolific breed of pigs is amongst the best and most profitable kinds.

No part has been taken in the competitions in the carcase classes at Smithfield, but one is able to make a comparison with that section of the show. In the year 1908, ten pigs competed in the class for pigs exceeding 220 lb. live weight and not exceeding 300 lb. live weight. The average age of these ten pigs was 316 days ; they gave an average carcase weight of $215\frac{7}{10}$ lb., which equalled an average daily gain of 10.90 oz.

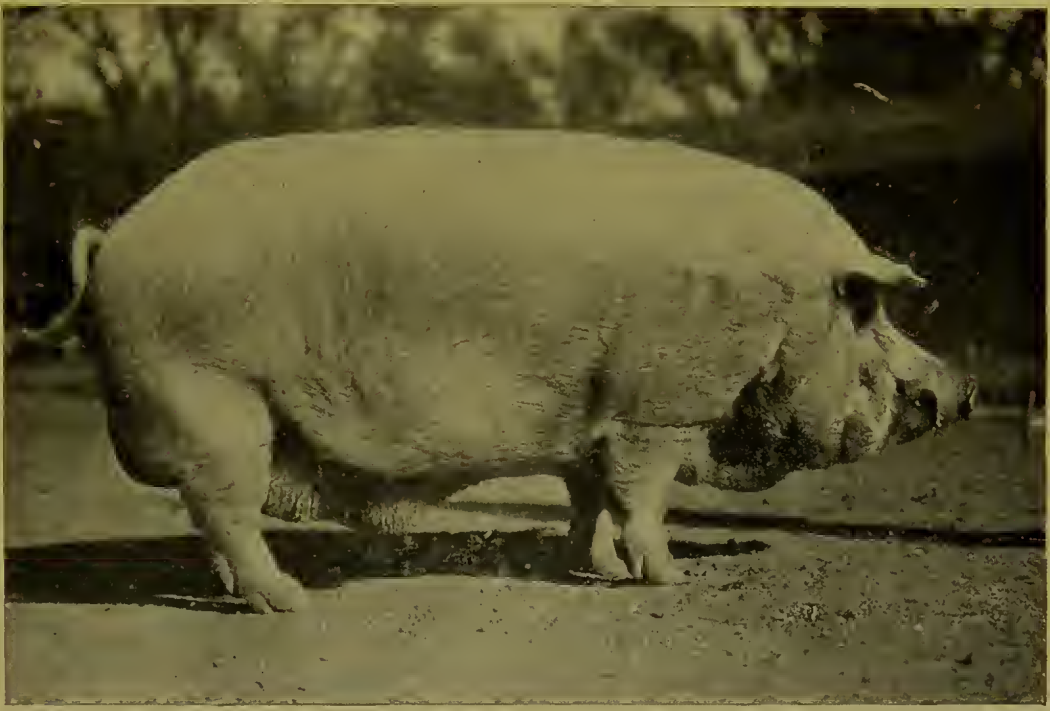
Ten pigs of the Lincolnshire curly coated breed, which at an average age of 161 days gave an average carcase weight of 178 lb.—being duly qualified, had they been entered to compete in the foregoing class—gave an average daily gain of 1 lb. 1.68 oz.

The points of excellence of the breed are given by the Association as follows :

Lincolnshire Curly Coated Breed

Colour	White.	
Face and neck	Medium length and wide between the eyes and ears	5
Ears	Medium length and not too much over face	10
Jowl	Heavy	3
Chest	Wide and deep	3

Shoulders	Wide	15
Back	Long and level	10
Sides	Very deep and ribs well sprung	10
Loin	Broad	5
Quarters	Long, wide and not drooping	5
Hams	Large and well filled to hocks	15
Tail	Set high and thick	3
Legs	Short and straight	5
Belly and flank	Thick and well filled	3
Coat	Fair quantity of curly or wavy hair	8
	Total	100



CHESTER WHITE BOAR

Objections

Head. Narrow forehead.
Ears. Thin.

Disqualifications

Ears. Pricked.
Nose. Dished or long.
Coat. Coarse, straight or bristly.
Colour of hair. Any other than white.

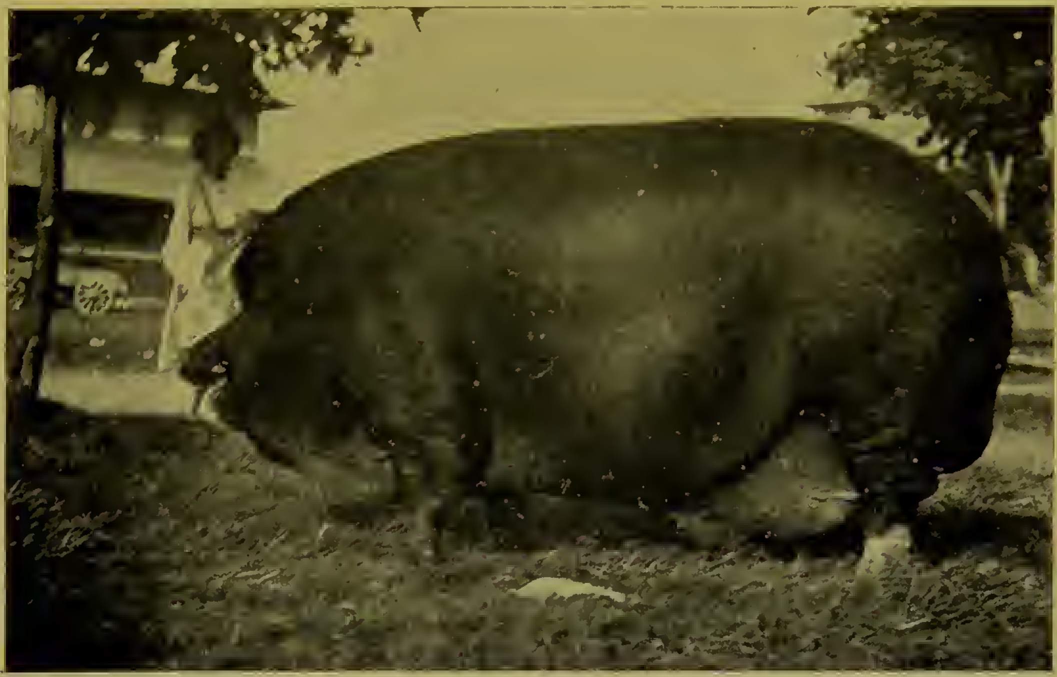
Minor Breeds of Swine. There are minor breeds of pigs in the United Kingdom, such as the spotted Gloucestershire, the Small Black, the Suffolk, the Essex, the Ulster White and some others, but the qualities which they possess have not brought them into prominence for bacon-curing purposes, and hence, although they may enjoy a local reputation, they are hardly likely ever to develop into popular breeds.

American Breeds of Swine. The American breeds of swine enjoy the variations of British types. The principal breeds, in addition to the British types already mentioned, are the Chester White, the Poland-China, and the Duroc-Jersey, and we cannot do better than quote a description of these different breeds from a publication issued by the Department of Agriculture, Ottawa, where their various characteristics are set forth :

" **The Chester White.** The Chester White hog is a native of Chester county, Pennsylvania, where the breed originated early in the nineteenth century. It was a large, white, coarse animal, having coarse head, heavy, lopped ears, coarse hide, long heavy tail and coarse hair. An improvement of the breed was commenced by the introduction, on a farm near Brandywine Creek, in Chester county, of a pair of very fine white hogs imported from Bedfordshire, England, in the year 1816. Enterprising farmers of the district commenced an improvement of their swine by the introduction of the prepotent blood of the imported stock. The produce of the first cross was so much superior to the original stock of the country that the new blood was eagerly sought by most of the leading farmers of the district. Encouraged by the improvement already secured, a system of careful selection and breeding was undertaken, with the chief object of securing a more suitable animal for the market. The improvement is said to have been continuous until the breed acquired an enviable reputation over a wide territory. The demand for breeding-stock soon exhausted the available animals. This circumstance provided unscrupulous men with an opportunity for doing the breed a serious injury. White pigs of all forms and descriptions were bought up and sent abroad as Chester Whites. The reaction was severe, as the breed received an unjustified condemnation. The demand for stock fell off seriously, and breeders of the genuine Chester White were able to again build up their herds. While the stock had undergone much improvement in quality, no attempt had been made to reduce the size. They were classed among the large breeds, and as such they reached the period when their breeders saw the wisdom of breeding to a standard, which they began to do about the beginning of the last quarter of the past century. Since that time improvement has been continuous. It has become one of the most popular breeds throughout the United States on account of its early maturing and easy-feeding qualities. In a few cases Canadian breeders have sought, by selection and management, to develop the form and quality of animal looked upon with favour by the packers, and are now producing an animal intermediate between the bacon and lard types ; but as bred in the United States, the Chester White is rather a 'Corn Belt' than a bacon animal. As a grazing-hog it is claimed to excel most of the other breeds. It is moderately long, thick, and deep and uniform in conformation.

" Boars in show condition should reach 500 lb. at two years of age, and sows of the same age and condition, 450 lb. Pigs six months old in market form should weigh from 150 to 175 lb.

“The standard of excellence for the Chester White, adopted by the various United States Record Associations, calls for an animal having well-arched neck, broad shoulders and back—qualifications very undesirable for bacon production. From the standpoint of the Canadian breeder, the standard should be modified to conform to the requirements of the bacon trade, as nearly as is consistent with the natural characteristics of the breed. When judging breeding animals by the following scale of points, due allowance must be made for musculinity in males and openness of conformation in females.



Poland-China Boar

“Scale of Points: Chester White

“ *Colour*	
Hair, white over pale pink skin	2
“ *Head and Neck* (9 points) :	
Snout, moderately fine, neat and tapering, face slightly dished	1
Eyes, good size, full and bright, and fairly wide apart	1
Jowl, full, neat and firm	3
Neck, medium length and full, with only moderate tendency to arch on top	3
Ears, medium size and thickness, soft, attached firmly to the head, pointing forward and slightly outward, and drooping	1
“ *Fore-quarters* (15 points) :	
Shoulders, full, smooth, rounded from side to side over top and very compact, no wider than back	9

Breast, good width and full ; chest full and low	4
Fore-legs set well apart, medium length and straight, pasterns upright, bone clean and moderately fine, feet compact and without tendency to spread when walking	2
" *Body* (40 points) :	
Back, medium width, rising slightly above the straight line and forming a very slight arch from neck to tail	9
Loin, strong and full, but not unduly arched ; wide as rest of back	5
Ribs, good length and well arched	3
Side, deep, long, smooth and flat between shoulder and ham	12
Heart-girth, full but without flabbiness at fore-flanks ; there should be no tucked-up appearance back of fore-legs nor slackness back of shoulder top	5
Flank, full and low	1
Under-line straight ; the belly should be moderately trim and neat unless in case of brood-sows	5
" *Hind-quarters* (14 points) :	
Rump, same width as back, long and slightly rounded from a point above hips to tail, and rounded from side to side over top	5
Ham, full without flabbiness, thigh tapering towards hock, carrying flesh well down both inside and outside of bone	4
Hind legs, medium length, hocks set well apart but not bowed outward ; bone clean and moderately fine, pasterns strong and upright ; feet firm and compact without tendency to spread when walking	4
Tail, small, smooth, tapering, well set on, not too high or low, curled	1
" *Quality* (15 points) :	
Ear rather thin, firm and of medium size (1) ; hair fine and abundant (2) ; skin smooth, showing no tendency to wrinkle (3) ; bone well defined and clean in legs, moderately fine in snout and head, and showing no prominence on side and top of shoulder (4) ; flesh firm and smooth with no flabbiness at jowl, fore-flank, belly, or ham (5)	15
" *Style* (5 points) :	
Active in movement, walking without a swaying motion, and standing well up on pasterns	5
Perfection	100

" *Objections.*—Narrow or sagging back ; too thin or too long neck ; sagging belly unless in brood-sows ; small, cramped chest ; pronounced depression back of shoulder ; rough shoulder ; prominent shield on boars ; wrinkled skin ; crooked or deformed legs or feet ; black hairs, black spots, curly coat or swirls ; very short snout ; very large ears lying close to face or small stiff ears carried erect.

" **The Poland-China.** The Poland-China hog originated in the Miami Valley, chiefly in the counties of Warren and Butler, in the State of Ohio. The conditions were favourable to swine-growing, and the City of Cincinnati became, prior to the middle of the past century, one of the greatest pork-packing centres in the world. Hog-raising was at that time the most profitable feature of farming in the surrounding country. Since there were no railways at that time, fatted hogs had to travel on foot to market, so that activity of the animals was as important as easy-feeding qualities. The hogs of the district were known by a variety of names, and were extremely cosmopolitan in their make-up. The foundation stock consisted of the native unimproved hog. Many settlers from Great Britain and other European countries brought hogs of varieties common in the districts whence they came, and in this way a constant change in the stock of the country was effected. With the improvement of roads and the introduction of railways, the activity of the animals became a secondary matter, and they rapidly became thicker and shorter in the leg.

" While hogs of various types were introduced into the Miami Valley, the breeds that did most in improving the stock were the Berkshire, the Russian, the Big China, the Byfield and the Irish Grazier. From about 1820 to 1840 the main crosses, instrumental in the formation of what later became the Poland-China breed, were introduced. The Berkshire gave the black colour and improved symmetry, the Big China improved the fattening qualities, while the other crosses gave size and strength. According to authoritative writers, no out-crosses have been introduced since 1845.

" Owing to the seemingly discordant elements of which it was made up, and the lack of a standard, the breed, then known as the 'Warren County Hog,' underwent many changes in conformation and colour prior to 1870. Up to this time the growing and fattening qualities of the animals were considered of much greater importance than colour or particular form. Having secured the desired qualities of fattening, leading breeders, about the date mentioned, decided, in a general way, upon the form and colour most desirable and upon the name Poland-China. Within a few years a number of organisations had been formed in the interests of the breed, and most of these adopted about the same standard of excellence. Attention was given to hastening maturity and to improving the quality and fattening powers, until we now have in the Poland-China one of the most economical meat-making hogs of the great 'Corn Belt' of the United States. Neither its form nor its carcase is in accordance with the requirements of the bacon trade ; hence the breed is not looked upon with favour by those closely associated with the development of the Canadian bacon industry.

"In general appearance the Poland-China is compact, symmetrical, full and round, smooth and inclined to massiveness in build. The characteristic colour is black, with white on face or lower jaw, white on feet and tip of tail; a few small, clear white spots on body are not objectionable. Boars two years old and over, in good condition, should weigh not less than 500 lb., and sows of same age and condition not less than 400 lb. With these points, a fairly accurate idea of the typical hog of this breed may be obtained.

"**The Duroc-Jersey.** The Duroc-Jersey hog, according to the most authentic historians of the breed, is the outcome of a union of the two classes of red swine known respectively as the Durocs and the Jersey Reds. The latter have been known to exist in a condition of greater or less purity in New Jersey and other Atlantic States for upwards of seventy years, while the former was for a long time the leading hog raised in Saratoga county, New York. The Jersey Reds were large in size, rather fine in quality, and of fair length and thickness. It is believed that the Jersey Red is descended from the earliest importations of the Berkshires, which, in their early days, were of a variety of colours, including buff, sandy and reddish brown, spotted with black. It is considered probable that the Durocs were descended from the same parent stock, but of this there is less certainty. The two varieties were for many years kept amid different environments, which would account for the lack of similarity between them when they were united, at a date prior to 1850, to form the Duroc-Jersey breed.

"The breed, from its early days, has been noted for docility, prolificacy and hardihood, qualities which have been well maintained. Size and weight were aimed at by improvers through many generations, and some twenty-five years ago the average of the breed was larger than at the present day. In 1877 breeders in Saratoga and Washington counties, New York, agreed upon a standard of characteristics that has been varied but little by more recently formed Record Associations. During the past two decades the breed has been improved in quality, easy feeding and early maturing propensities, and is now held in about equal favour with the Poland-China and the Chester White in the leading pork-producing areas of the United States.

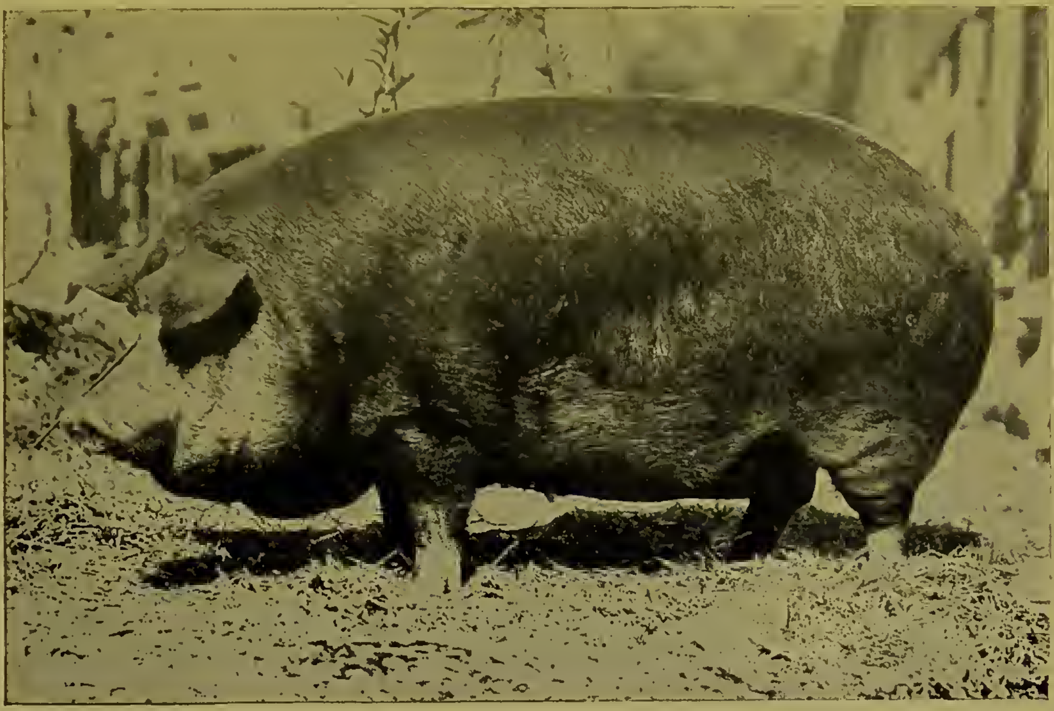
"The Duroc-Jersey has a few admirers in Canada, but its thick, fat form, as seen in the leading herds of the United States, is so unsuited to the requirements of the bacon trade that its popularity has not extended to any extent north of the international boundary.

"The Duroc-Jerseys, with their moderately long, straight heads, drooping ears and smooth, neat bodies, bear a rather close resemblance to the Poland-Chinas in form, but they are somewhat stronger in limb. Boars two years old in good condition should weigh not less than 600 lb., and sows of similar age and condition 500 lb. Their colour is cherry-red without other admixture."

Danish Pigs. The Danish bacon-curing industry is of modern growth, and its present large dimensions followed upon the prohibition by Germany of the import of the Danish live pigs into that country, which took place in 1887. The development of bacon-curing in Denmark from that date until now has been phenomenal, and there can be no doubt that the intimate relation which exists between dairying and bacon-curing has been recognised to a greater extent in Denmark than in any other country.

As in other countries, however, the present pig stock is largely derived from British sources, and the breeds in existence are mostly those of the Yorkshire type.

The history of the Danish breeds is succinctly given by Dr. Andrew Fossum in a publication by the United States Government: * "It is stated by Mr. P. A. Mörkeberg, State adviser in hog-breeding to the Danish Government, that in the early part of the last century Denmark had two breeds of hogs—the Jutland and the Zeeland, the latter otherwise known as the Island breed. The former were tall and precocious, had long bodies and legs, a sharp, arched back, and drooping ears. The Zeeland (or Island) breed was small, with compact body and erect ears, and heavy mane-bristles along the back. Both breeds were easily kept, and subsisted for the greater part of the year on what they found in the field or forest. Neither breed has continued in a pure state to the present time, as they proved unsuitable for modern purposes. They were too slow to mature and did not have the form wanted in the modern slaughter-house—that is, large hams and thick sides.



Duroc-Jersey Sow

"In the beginning of the nineteenth century Denmark produced a comparatively large number of hogs and exported some. Erik Viborg,

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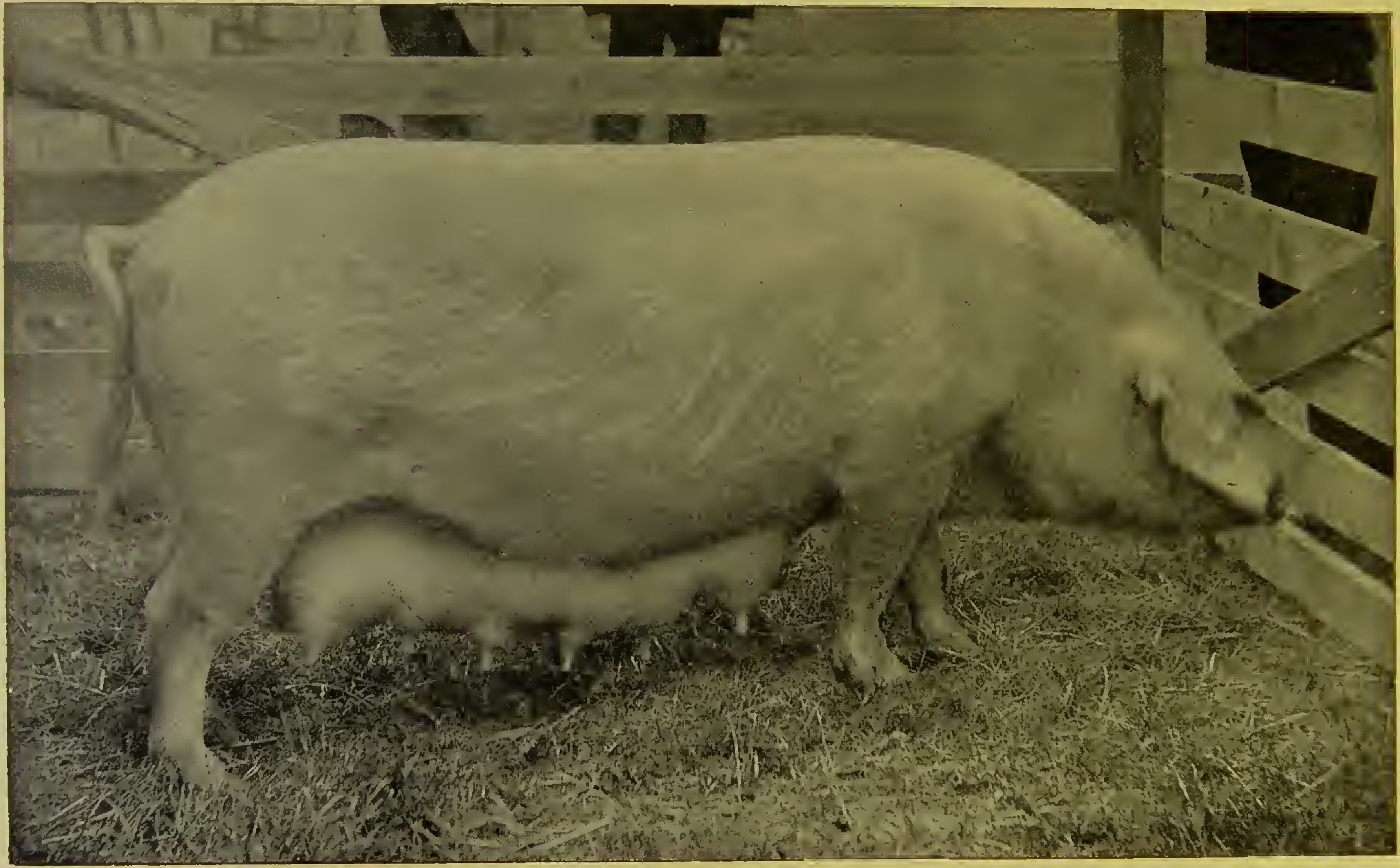
* "The Danish Hog Industry." By Andrew Fossum, Ph.D., U.S. Department of Agriculture.

professor in the veterinary school at Copenhagen, is authority for the statement that Jutland alone exported yearly more than 10,000 hogs and 1,280,000 lb. of pork. An average weight of 180 lb. per head would make this an annual export of about 3,000,000 lb. Of the native Jutland hogs many were bought up and driven south into the so-called marsh country along the ocean north of the Elbe. But it is not possible to say how many were taken away annually. Buyers called *prangere* bought up the hogs and drove them in herds from town to town and from district to district, constantly increasing the herd on the way. This trade continued till Denmark lost the provinces of Schleswig and Holstein in 1864."

Denmark's Importation of Breeds. " Importations of English breeds commenced about the beginning of the nineteenth century. Other importations came from Holstein and Mecklenburg, and as these were partly of English blood the movement made for improvement tended in the same direction.

" In the second quarter of the century the Danes paid more attention to hog-breeding. They imported a number of foreign hogs of different breeds, which they kept pure or crossed with the local breeds. The object was to render their own stock more contented and easily kept, but the foreign breeds were smaller than the native hogs. Thus by the middle of the century foreign blood had come into the country in different ways. Almost every locality could show different shades of breeding, due to the numerous sources of origin. No general breed, however, prevailed in the country. Although these animals of the mixed breeds did not attain the size of the old Danish breed, they were more easily kept and matured more rapidly.

" Mr. Mörkeberg, the Danish hog expert previously mentioned, assumes that in 1850 the old Danish breeds still existed generally throughout the country, and that the improved breeds were found only in a few localities. But soon after the middle of the century the dairy industry began to develop, and this brought about changes in the hog industry as well. The dairy industry yielded a rich and abundant supply of feed that was eminently suitable for producing bacon. Crossing with English boars was especially successful, and this brought about a growing demand for English breeding animals. These crosses would often attain a weight of 200 lb. in seven or eight months and 300 lb. before the end of the first year. The rapid development of these cross-bred animals, as compared with the slow growth of the native breed, increased the demand for English breeding hogs to such an extent that the census of 1871 shows 1064 English as against 1072 Danish boars in the entire country. These English boars were not all imported direct. Enterprising Danish breeders would import a boar and a few sows and form breeding-stations. From these stations pure-bred stock spread over the country by hundreds. Thus, on the estate of Henneberg there existed an important breeding-station from 1874 to 1886. Beginning with one boar and three sows of the Middle White Yorkshire breed, this station alone disposed of some



Land Race Danish Pig

300 boars and 400 sows, and had a determining influence in developing the hogs in Fyen and Jutland. Thus, although the imports of English hogs were most numerous during the years 1852 to 1863, the English influence on Danish hogs was doubtless greater in succeeding years when pure-bred stock multiplied in the country itself."

Changes in the Methods of Breeding. "Towards the close of the seventies Denmark possessed a good breed of hog well adapted to the local conditions and satisfactory to the Hamburg market, which it then supplied. This market demanded a so-called fat hog of 250 to 300 lb. live weight. But a lack of uniformity characterised the hogs of this period at the exhibitions. Almost as many types were shown as there were hogs, and it was necessary to warn breeders of the fact that every cross was not necessarily an improvement. Although they all bred for the same purpose, they made use of several breeds, which shows that they had not learned to specialise the industry.

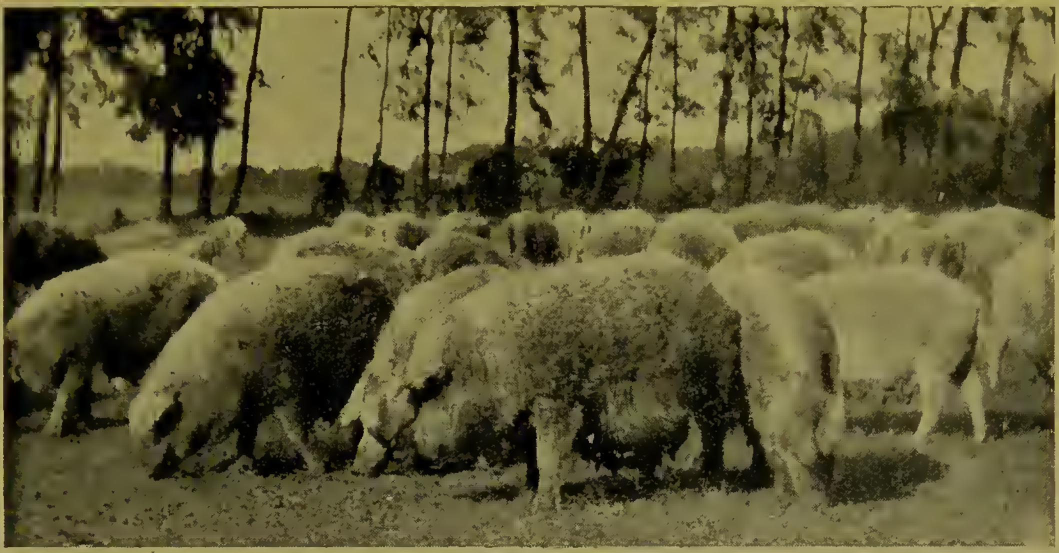
" A change in the method of breeding occurred about 1880, resulting from a change in the market conditions. England began more and more to buy Danish bacon. The demand was for hogs weighing from 160 to 200 lb. The hogs shipped to Germany were too fat, so that a new system of crossing took place to supply this demand, and gradually Denmark shifted from the Middle White Yorkshires to the Large White Yorkshires. This crossing was most successful in the district of Holstebro, where, as it happened, the old Danish breed still remained almost intact. The new cross proved successful, and the bacon from this district was in great demand in the London market. The farmers made an effort to get rid of their fat hogs and to replace them with the so-called Holstebro breed. As their hogs were often of a mixed nature, the farmers adjusted themselves to the best market and sold fat hogs to Germany and bacon to England. Some fat hogs, too, found a market in middle England. Farmers also counted on the possible revival of the German trade, but with the German prohibition of 1896 England remained the only market, and this also simplified the breeding problem."

It is a remarkable thing that since the establishment of the first Farmers' Co-operative Bacon Factory in Denmark there has been such a rapid development in the breeding of hogs for bacon-curing purposes. The number of pigs killed in these co-operative factories in 1888 was 23,407, and this figure increased in 1908 to one and a half millions. The total number of pigs killed in Denmark may be approximated at two millions per annum, the difference between those handled by the co-operative farmers and the total being what pass through private bacon factories.

Other Notable Breeds of Pigs : Craonnais. In France, as in other countries, the modern races of pigs have been largely mingled with British stock, but there has been evolved out of the mixed races a distinct type which has been more particularly developed in the Craonnais country, which is the district situated round about Craon in the vicinity of Château Gonthier, in Mayenne. The Craonnais pig has been known from time immemorial, but its present-day conformation is largely attributed to the introduction of Berkshire crossings, so that, while the Craonnais pig is characterised by the length and breadth of the body, it has short legs and a small head, the chest is deep, the limbs are small, the head of medium size with a large snout, and the ears are folded over just sufficiently not to obscure the eyes.

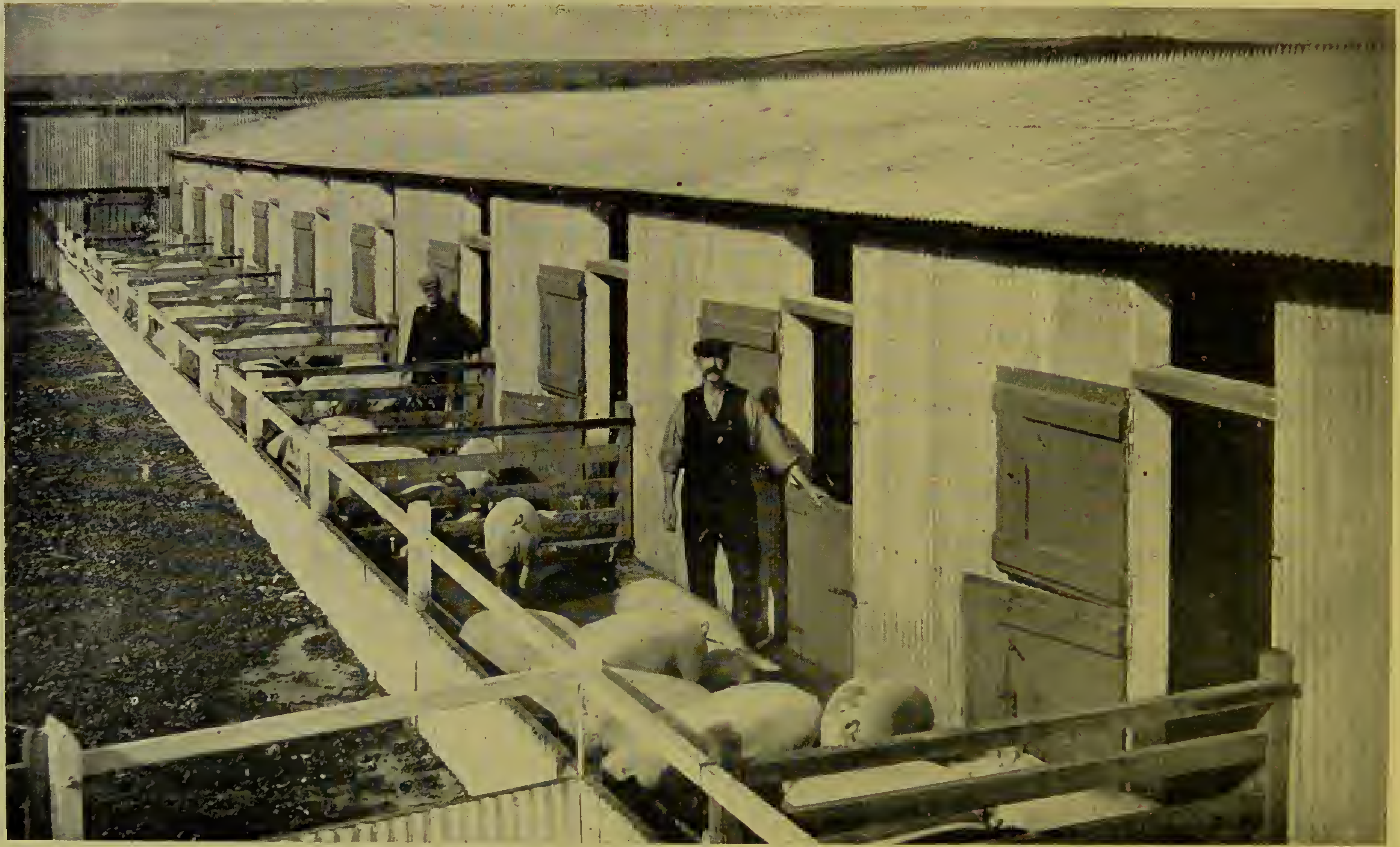
It is this type of pig which is largely scattered all over France, and the modern breeders have devoted much attention to improving the original race, more especially by the introduction of English stock.

Hungarian Pigs.—One of the most remarkable pigs is that which is known in Hungary as the Mangalicza or Mongolian pig. It belongs to the very early type of wild pig known in the East, and while it is characterised by rough curly hair, it has also a very thick layer of fat deposited all over the back, amounting in a full-grown pig to about five inches in depth. This feature of the Mangalicza swine is not altogether undesirable in a country like Hungary, where the fat is largely appreciated in place of butter. The rapid development of agriculture in Hungary, however, has shown that the Mangalicza is not the most profitable breed for the country, and, as a consequence, efforts have been made to introduce breeds of pigs from the United Kingdom, and these are either being crossed with the Mangalicza or are being used to supplant them altogether, so that Hungary may yet become a large bacon-curing country; an industry for which it would seem to be particularly well adapted.



Mangalicza Pigs in Hungary

Generally speaking, it may be said that in Europe and America, and for that matter also in the British Colonies, the principal breeds of swine owe their origin to the careful selection of breeds which has taken place in the United Kingdom, and the conformation of the bacon-curers' type of pig has been so well studied there that breeders have now arrived at a perfect understanding as to the kind of animal which is required.



THE BREEDING OF PIGS: A VIEW OF WELL-DESIGNED STIES

The conditions under which pigs are fattened contribute largely to their quick development, and well-designed sties make a great difference in the quickness with which the pigs grow.

CHAPTER VI

THE DISTRIBUTION AND BREEDING OF PIGS

As we have seen in the previous chapter, the conformation of pigs is due, to a large extent, to the demands of bacon-curers, and that may be taken as the governing factor in connection with swine husbandry. There are many pigs used, however, in connection with the pork trade and which are required as fresh pork, and in various parts of the country these pigs may weigh from 60 to 300 lb. In London, notably, there is a large demand for small pork, such as is derived from pigs averaging 60 lb. dead weight. In some of the country districts there is very little demand for this class of pork, and larger pigs are therefore bred for this particular purpose.

The bacon-curers' point of view, however, is what rules amongst pig-breeders, and this has been recognised more and more within recent years, during which time bacon-curing has been recognised as a substantial industry associated with agriculture. The breeding and feeding of pigs, therefore, are important branches of agriculture, and their magnitude may be gathered from the statistics which are available showing the number of pigs which exist in the United Kingdom. The tables which follow show that the total pig population of the United Kingdom is something over 4,000,000, and these are distributed pretty nearly equally all over the country, although there are notable exceptions, such as the counties of Suffolk, Somerset, Norfolk, Cork, and some others, which considerably exceed 100,000. The reason of these large numbers is to be found in the rapid development of dairying in the districts referred to, and the recognition of the fact that pig-breeding is the natural corollary of modern dairying, inasmuch as separated milk forms one of the principal foods of swine.

Tables showing the Distribution of Pigs in the United Kingdom by Counties

England

	1908.	1907.
Bedford	32,038	27,977
Berks.	26,171	23,822
Buckingham	32,387	29,959
Cambridge	62,029	55,706
Chester	89,525	87,391

	1908.	1907.
Cornwall	104,813	103,704
Cumberland	17,243	18,841
Derby	33,407	31,322
Devon	106,175	101,054
Dorset	57,793	56,340
Durham	15,211	13,810
Essex	94,034	83,689
Gloucester	84,177	77,084
Hants	70,892	65,618
Hereford	33,116	29,373
Hertford	28,680	26,942
Huntingdon	21,494	20,187
Kent	73,115	68,319
Lancaster	80,426	81,990
Leicester	28,195	24,598
Lincoln	134,044	116,323
London	2,106	2,038
Middlesex	16,047	15,133
Monmouth	18,218	17,593
Norfolk	118,984	104,664
Northampton	36,098	31,071
Northumberland	12,276	11,790
Notts	35,196	31,131
Oxford	35,887	32,447
Rutland	2,971	2,285
Salop	85,191	77,667
Somerset	131,852	128,266
Stafford	57,010	53,313
Suffolk	174,262	158,101
Surrey	26,409	22,523
Sussex	47,167	41,818
Warwick	40,471	35,227
Westmorland	4,767	4,729
Wilts	64,124	61,736
Worcester	51,224	45,536
York, East Riding	70,717	64,083
,, North Riding	61,965	57,013
,, West Riding	121,180	114,923
Total for England	2,439,087	2,257,136

SCOTLAND

	1908.	1907.
Aberdeen	13,778	14,243
Argyle	4,616	4,402

	1908.	1907.
Ayr	13,936	13,980
Banff	3,610	4,001
Berwick	3,974	3,547
Bute	616	596
Caithness	1,684	1,763
Clackmannan	940	1,164
Dumbarton	1,249	1,260
Dumfries	9,280	9,362
Elgin, or Moray	2,798	2,922
Fife	5,884	6,358
Forfar	6,849	7,667
Haddington	1,939	1,864
Inverness	2,550	2,674
Kincardine	2,839	3,142
Kinross	690	646
Kirkcudbright	9,970	9,448
Lanark	7,226	7,026
Linlithgow	1,431	1,415
Midlothian	8,798	9,827
Nairn	627	776
Orkney	2,333	2,823
Peebles	590	630
Perth	7,548	8,181
Renfrew	1,444	1,800
Ross and Cromarty	4,811	4,008
Roxburgh	3,159	2,862
Selkirk	447	384
Shetland	1,411	1,481
Stirling	1,945	2,199
Sutherland	764	732
Wigtown	14,048	13,640
Total for Scotland	143,784	146,634

IRELAND

	1908.
Antrim	63,529
Armagh	27,073
Carlow	23,318
Cavan	56,724
Clare	39,271
Cork	154,788
Donegal	26,206
Down	43,923
Dublin	11,760
Fermanagh	18,920

	1908.
Galway	66,276
Kerry	63,352
Kildare	13,810
Kilkenny	34,473
King's	28,883
Leitrim	25,003
Limerick	52,768
Londonderry	36,876
Longford	23,518
Louth	16,954
Mayo	71,641
Meath	14,106
Monaghan	38,145
Queen's	31,814
Roscommon	40,541
Sligo	28,250
Tipperary	77,725
Tyrone	42,229
Waterford	34,951
Westmeath	15,790
Wexford	73,897
Wicklow	20,554
Provinces	
Leinster	308,877
Munster	422,855
Ulster	353,625
Connaught	231,711
Total for Ireland	1,317,068

WALES

	1908.	1907.
Anglesey	15,629	15,317
Brecon	8,241	8,104
Cardigan	22,606	21,665
Carmarthen	38,175	37,778
Carnarvon	18,263	18,433
Denbigh	30,833	28,727
Flint	21,170	19,389
Glamorgan	17,194	17,217
Merioneth	7,447	7,832
Montgomery	24,575	21,903
Pembroke	31,673	31,822
Radnor	4,805	4,809
Total for Wales	240,611	232,996

ABSTRACT SHOWING TOTAL NUMBER OF PIGS IN THE UNITED KINGDOM IN 1907–8

	1908.		1907.
England	2,439,087	..	2,257,136
Wales	240,611	..	232,996
Scotland	143,784	..	146,634
Ireland	1,317,068	..	—
Total in the United Kingdom	4,140,550	..	—

Where the Dairy Farmer excels. This aspect of the question has been clearly described by a writer in a New Zealand journal,* who says :

"When it comes to pig-raising, the dairy farmer is easily in front of his brother in other departments of the farming business, because he has one of the most valuable pig-foods in the world as a by-product. The trouble is that he does not know the value of it, and too often will not learn. He wants the Government Experiment Station to try something in the pig-feeding business, and then, well : as often as not, he won't profit by what they have done. At least ten times we have published full particulars of the most interesting pig-feeding experiment ever made in the world, and on talking it over with very old subscribers, who have been taking the *Dairyman* for years, they all admit that they 'never noticed it.'

"The first thing that has to be remembered when milk is forming part of the feed is that, if you give a pig two gallons of skim-milk a day, you are wasting one gallon. The second thing you have to remember is that you can't have economic pork production if the pig does not get a certain amount of starchy foods each day. The third thing you have to remember is that, if you feed meal by itself, you are wasting half the meal. The fourth thing is that what is the cheapest and best pork-producer in the world has already been found out, and that you don't want to be trying to find this out at your own expense. And here it is :

One gallon of skim-milk.
Three pounds of potatoes.
Four pounds of barley-meal : per pig per day.

On this, pigs from 80 to 120 lb. weight will put on 15 lb. of pork per week which, at 4*d*. per lb., is 5*s*. per pig.

"And then cut this table out and put it somewhere so that the person who feeds the pigs may have it always before him.

"The values of the different feeds are shown by points.

	Points.
"(1) Barley-meal, skimmed milk, and potatoes	1000
(2) Barley-meal and milk	903
(3) Maize-meal and milk	877
(4) Maize-meal and bean-meal	590

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* *New Zealand Dairyman*, October 20, 1907.

	Points.
(5) Barley-meal	519
(6) Maize-meal and pea-meal	489
(7) Maize-meal	484
(8) Barley-meal and bran	499
(9) Maize-meal and bran	404 "

Unfortunately, during recent years there has been a tendency towards breeding fewer pigs, and this not only applies to the United Kingdom, but also applies pretty generally all over the world.

The present writer has elsewhere shown that this is very serious for farmers everywhere, and more especially for farmers in the United Kingdom.

A Serious Outlook for the Farmer. The following is taken from a brochure issued by the present writer in September 1909, and which shows exactly the position of affairs at that date : *

" From day to day the evidence continues to accumulate showing that the bacon markets of the world are hopelessly disorganised, and that in so far as swine husbandry is concerned we are passing through a critical time. It is, in fact, a curious state of affairs, and calls for special comment, not only from all who are interested in the prosperity of agriculture, but from those also who are specially concerned with securing steady markets in the provision trade. Apparently the shortage began about the beginning of the present year (1909), and has been more especially marked in the United Kingdom, but it exists also in the United States, Canada, and Denmark, these being the principal bacon-curing countries of the world. In the United States the outlook is indeed a serious one, not only for that country itself, but for the export trade. Actual records show, for example, that the number of hogs packed on what is known as the Western Markets, and which include Chicago, Kansas, South Omaha, St. Louis, Cincinnati, and other towns, to the number of sixteen, as also smaller towns in the same territories, exhibit a very considerable shortage as compared with last year. From March 1 to September 1 in each year the figures were as follow :

" NUMBER OF PIGS PACKED ON WESTERN MARKETS, UNITED STATES OF AMERICA

" 1908	12,975,000
1909	11,735,000
Shortage	1,240,000

" This is only one feature of the situation, which now looks very black indeed owing to the estimated shortage which is likely to occur in the corn crop. The agricultural department of the United States estimated early in the present year, in the month of July, that the corn or maize crop would amount to 3300 million bushels. Since then, however, weather conditions have upset all the calculations made, and it is anticipated that the crop will not now be more than 2600 million bushels. As hogs are fed principally on maize in the United States, this means a considerable falling off in the food-supply, which is bound to react on the breeding of swine. Hence it is that future deliveries of bacon and hams are being contracted for at prices far beyond anything that has been known to the present generation.

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* See also *Transactions of Highland Society of Scotland*, 1910, where an extended survey of the present position is given.

"This condition of things affects us in the United Kingdom in this way: the imports of pig products for 1908 from the United States into the United Kingdom were as follow:

"Fresh pork	135,152 cwts.
Salted pork	67,438 ,,
Bacon	2,541,945 ,,
Hams	900,795 ,,
	3,645,330 ,,

"Since January 1 of the present year (1909), however, there has been a steady falling off. Thus, at Liverpool and the Mersey ports there was a decrease in the imports of boxed meats up to August 30, which compared as follows:

"BOXED MEATS RECEIVED AT MERSEY PORTS

"1908	511,100 boxes
1909	399,000 ,,
Shortage at Mersey Ports	113,200 ,,

"The imports from Denmark and Canada have also been short, and reports from both of these countries indicate that it will be impossible to increase the output for a long time to come."

The High Prices of Bacon. "Naturally, such a condition of things has affected the prices of bacon, and, as a consequence, at the moment we have phenomenal prices being realised throughout the country, and there is every indication of these going yet higher. Canadian bacon is quoted at 73*s*. to 76*s*. per cwt., Danish at 76*s*. to 79*s*., Irish at 74*s*. to 77*s*. These are wholesale prices, of course, and represent the values on the exchange for large quantities. After sales have been made on the basis of these figures, several other intermediate handlers have to secure a profit before the counter of the grocer is reached, and the consumer then buys at a retail price. But these wholesale prices are far beyond the normal: 60*s*. per cwt. would be a fair average price for home bacon, now there is some talk of prices exceeding 80*s*. and even going up to 90*s*. per cwt. As has been said, it is a curious situation, and is the result of a combination of circumstances such as has never happened before. For years back the average import of pig-products has been fairly steady, as will be seen from the official figures following, and which show the imports of bacon, hams, and lard for the last three years.

	Cwts.		£
" Bacon, 1906	5,413,056	..	14,306,290
" 1907	5,250,955	..	14,533,985
" 1908	5,604,772	..	14,249,263
Hams, 1906	1,269,942	..	3,364,596
" 1907	1,097,397	..	3,098,028
" 1908	1,184,337	..	2,937,983
Lard (excluding imitation lard), 1906.	1,857,088	..	3,959,656
" " " 1907.	1,800,151	..	4,112,058
" " " 1908.	1,876,656	..	4,151,138

"These figures indicate fairly steady markets, which, during the present year, will be entirely altered. The shrinkage in this department of our food-supply cannot be less than 20 per cent. The supply of pig-products from the United States was at its highest between 1898 and 1901, and since then it has suffered a continuous decline, which has, however, been counterbalanced by supplies from Canada, Denmark, and other countries. The average total quantity imported has been about the same.

"Naturally, under such circumstances, we turn to our home conditions in order to see if anything is being done to avert the coming famine, and at the very outset are met with the figures from the preliminary statement issued by the Board of Agriculture, in which the numbers of live-stock in Great Britain are given. We find that there is a lamentable shortage of pigs as compared with 1908. The figures are as follow :

"AGRICULTURE RETURNS UP TO JUNE 4 IN EACH YEAR

	1909.		1908.
" Sows kept for breeding purposes .	316,552	..	369,476
Other pigs	2,064,335	..	2,454,006
Totals	2,380,887	..	2,823,482

"These show a decrease of 52,924, or 14.32, of breeding sows as compared the one year with the other, and a total decrease in the pig-supply of Great Britain of 442,595, or 15.7 per cent. In so far as Ireland is concerned a very considerable shortage is also to be recorded here, and unfortunately one of the items is a smaller number of breeding sows by about 20,000."

Swine Husbandry in Peril. "It will thus be seen that we have reached a perilous condition in so far as swine husbandry and bacon-curing are concerned. The demand for pig-products goes on increasing from year to year, and it seems difficult to understand why farmers do not endeavour to cultivate pigs to a greater extent. Year in and out, they yield a larger profit than any other live-stock, inasmuch as they can be fed on food which would otherwise be wasted. It is true that at the moment feeding-meal is dear, but even at the present price of about

9*s*. per cwt. there is a handsome profit in pig-feeding. In ordinary times there is a good profit with pigs fetching 42*s*. per cwt. dead weight. Such a figure pays the farmer and pays the bacon-curer. At the moment, however, the dead weight of pigs is about 6*d*. per lb., and in some markets rather more.

"Now, surely, is the opportunity for the British farmer. Many countries are looking to the United Kingdom as an outlet for the product from new bacon and pig-product establishments now being constructed. Some of these are as far away as China! Only recently a cargo of frozen Chinese pork was brought to London and has been absorbed without any trouble. Now it is proposed to cure the pig on the spot in that country and ship the product to the United Kingdom in the finished state. In Russia, again, new bacon factories are being constructed, as also in France and in some other European States, all with a view to supply the British market. Why should not the farmers of the United Kingdom try to do some of this supplying themselves?"

The Example of Denmark. "We send away upwards of £20,000,000 per annum to foreign countries for pig-products, and much of it could, with a little organisation, be retained at home. It will be remembered that, about 1887, the farmers of Denmark were, without warning, prohibited from sending their live swine into Germany, and they at once formed themselves into co-operative societies with the object of fostering swine husbandry and erecting bacon factories. They knew that the British farmers were not taking advantage of their opportunities, and that there was plenty of demand for bacon in England. The latest available Consular report tells the remainder of the story. It says:

"'The first co-operative slaughter-house was founded in 1887 in Jutland (Denmark); in 1897 there were twenty-one co-operative slaughter-houses with a membership of 42,000; in 1900, twenty-six slaughter-houses and 60,000 members; in 1905, thirty-two slaughter-houses and 70,000 members; and in 1908, thirty-three slaughter-houses and 101,456 members.

"'During 1908 the Danish co-operative slaughter-houses accounted for 1,549,550 pigs, against 1,311,241 pigs in 1907, besides 16,004 cattle and 14,344 calves.

"'Other slaughter-houses in Denmark slaughtered about 500,000 pigs, thus bringing the total number slaughtered in the country up to over 2,000,000.'

"So much for organisation and taking advantage of opportunity. Most of the bacon referred to in these figures was sold and eaten in the United Kingdom.

"This is therefore primarily a question for farmers and farmers' societies. There are many areas in the United Kingdom where bacon factories would undoubtedly flourish because of their proximity to pig-growing districts, and also because of the facilities for conveying produce to large towns. In cheese-making and dairying districts this is especially so, as the by-products of the dairy, in the shape of whey or separated milk, are amongst the best feeding-stuffs in a pig-feeding ration."

THE BREEDING OF PIGS

In a leaflet issued by the Department of Agriculture and Technical Education of Ireland, under the heading of "The Breeding and Feeding of Pigs," it is stated that the best type of pig to feed and rear for marketable purposes is an animal possessing the following points, which suit alike the breeder, feeder, and consumer in the United Kingdom:

(1) *Neat head.* The pig that is very long in the head is usually narrow between the eyes, has seldom a very strong constitution, and has rather more bone than is required. On the other hand, the pig that is very short in the head is usually too fat, too heavy in the fore end, thick in the neck, and heavy in the shoulders. Neat in the head means neither too long nor too short a nose. The ears should be fairly large, soft and pliable, and should fall a little to the front without actually being lopped.

(2) *Light neck and shoulder.* The coarser parts of a side of bacon, and those which fetch the lowest price, are the neck and shoulder. The lighter these parts the better the side, and the higher the price it will make.

(3) *Deep heart and well-sprung ribs.* Pigs are usually deficient in these points, which are, perhaps, the most valuable of those here enumerated. For stock purposes, breeders should, therefore, select only those animals which have these characteristics strongly developed.

(4) *Thick loins.* A pig with a good loin is almost invariably well ribbed, and has a strong constitution. From a breeder's and feeder's point of view a good loin is most essential.

(5) *Stout thighs.* This means a pig thoroughly well developed in the hams. The hams are the most important parts of the animal, and, in the case of pigs killed for the ham and middle trade, the most valuable of all, provided they are not too fat.

(6) *Short legs.* A pig that is long in the leg is nearly always flat in the ham and lacking in plumpness.

(7) *Long and silky hair.* Good hair is an indication of strength of constitution as well as lean meat. The absence of hair generally proceeds from close breeding, and indicates a tendency to excessive fatness.

(8) *A long side of moderate depth, with thick flank.* This type of animal should be aimed at, whether thoroughbred, half-bred, or common-bred pigs are kept.

To produce pigs having these qualities, the first consideration must be the selection of the boar. It is said that the boar is half the herd. Even this estimate undervalues his power of reproducing his like. It is, therefore, all-important that a boar possessing the particular points described should be obtained.

At present the improved Large White Yorkshire appears to be the breed which possesses the required points, and a sire of this breed should therefore be selected.

The pig that commands the highest price is an animal which, when well finished and not over-fat, weighs 12 stone dead, or about 15½ to 16 stone living. A good pig ought to arrive at this weight at the age of seven months from birth.

In selecting a sow, there are a few points which a good specimen should possess, in addition to those mentioned for the boar. The sow should be docile and should have at least twelve teats, of an equal size, and evenly placed well forward on the belly. Sows having large flat teats generally secrete very little milk, and on this account prove bad mothers. The fineness of the hair, skin, and bone, all indicate a good quality of flesh, and an animal that is likely to become a good mother.

Hints on Feeding. Pigs should be well fed, but not over-fed. It is only when fed regularly that pigs give the most satisfactory results to the feeder.

During the first half of the sixteen weeks which a sow goes in pig she should be allowed to run on grass, and should receive a limited amount of other food. For the last eight weeks she should be treated more generously, so that she may be in good condition, but not too fat, at the time of farrowing. During the time the sow is rearing her litter, she should receive as much good food as she will take, consisting of boiled potatoes, Indian-meal porridge, pollard, bran, and skim-milk.

At three weeks old the young pigs begin to eat, and at this time should be supplied with skim-milk, separated milk, or fresh buttermilk, which may be mixed with a little pollard, bran, and boiled potatoes, and given twice or three times daily. Care should be taken to prevent the young pigs having access to the sow's food. The sow may be permitted to eat up the food which the young pigs may have left ; but if the young pigs eat the sow's food they are almost certain to scour. When eight weeks old the young pigs may be weaned. After weaning they should receive the same quality of food in a sloppy condition, and be allowed a little exercise.

When the pigs have reached about 1 cwt. in live weight, the amount of exercise allowed them must be limited. The food should now consist of boiled potatoes broken up and mixed whilst hot with a quantity of raw Indian-meal and pollard, or barley-meal. After the pigs have eaten as much as they appear to require, a small quantity of buttermilk, skim-milk, separated milk, or kitchen refuse should be added, to induce them to clean up all the food given them. The quantity of food which a pig should receive is just what it will eat up clean, no more and no less. Turnips and mangels are sometimes used instead of potatoes, but potatoes give by far the best results.

When being fattened, pigs should be fed three times a day. The food ought to be brought to a temperature of 90° Fahr. by direct heating or by the aid of hot water. By so doing much of the food is saved in the animal's body for the production of fat.

The Effect of Oats on Pigs. The addition of oats to the food of pigs, which are being finished, improves the whiteness of the fat and makes the flesh firmer. The pigs should therefore receive oatmeal or bruised oats during the three or four weeks previous to the time at which it is intended to kill the animals. During this period they should be allowed neither turnips nor mangels. When the food contains a large proportion of brewery or distillery by-products the fat produced is soft and of a yellowish colour, and the meat is not of good flavour. The excessive use of such products is therefore to be avoided.

Every farmer should try and breed the store pigs he requires, because, in the first place, a pig eight weeks of age should not have cost more than 8*s*. to produce, whereas more than double this amount has generally to be paid in the open market for such a pig. Furthermore, pigs reared on the farm fatten more readily, and are therefore more economical than pigs bought in the open market.

Swine-fever is the disease most dreaded by farmers. This, it should be clearly understood, is a germ disease, and is never spontaneous in its origin. The sole cause of swine-fever is the introduction into the system of a healthy pig of the specific germ from the body or excreta of a diseased pig. There is reason to believe that the disease is not unfrequently conveyed to places at which swine are kept by means of persons who have been in contact with diseased animals elsewhere. The farmer who breeds the pig he feeds is less likely to suffer loss from this disease than the farmer who buys in the open market.

Great care should be exercised in keeping the houses in which pigs are accommodated clean and comfortable.

Cleanliness of the sties and feeding of pigs on suitable food are quite essential if the animals are to be kept in a healthy condition, and thus have power to resist infection.

Directions for Feeding and Fattening. It will be noticed that these points refer particularly to the bacon-pig, and these might be supplemented by authoritative quotations from various sources. Thus, Youatt, in his book on the pig, lays down the following general directions for feeding and fattening :

" Regular hours of feeding rank among the first of the rules which ought to be observed ; the pigs will soon learn to expect their meals at certain times, and the stomachs will be ready for them ; irregularity will therefore irritate the digestive powers, and prevent so much benefit being derived from the meals when they do come.

" Small meals, and many of them, are preferable to few and large ones, for swine are very apt to gorge and over-eat themselves, or, if any be left in the trough, to return to it by fits and starts until it is all gone ; in both cases the digestive functions are impaired, and the process is not fully and beneficially performed. The best remedy for indigestion is to let the animals fast for four-and-twenty hours, and then to give them a small quantity of dry food, as barley or peas, whole and salted, and let them fast four or five hours more before resuming their usual food.

"Pigs always eat more when first put up to fatten than they do afterwards; therefore the most nutritious food should be reserved until they are getting pretty fat. And at that period the food must be varied, for the appetite being diminished, it becomes necessary to excite it by variety; and, besides, the same aliment constantly given palls upon the stomach, and is incapable of supplying in itself all the various kinds of nutriment required by the increased and altered state of the body."

The Value of Cleanliness. "Cleanliness is another *sine qua non.* There is no idea so utterly without foundation as the common one that 'pigs love dirt,' and that these animals thrive best in the midst of filth. We will quote one example out of the many which have come to our knowledge in refutation of this absurd opinion. 'A gentleman in Norfolk put up six pigs of almost exactly equal weight, and all in equal health to fatten; treated them, with one exception, all exactly the same, and fed them on similar food, given in equal quantities to each, for seven weeks. Three of these pigs were left to shift for themselves so far as cleanliness went, and the other three were carefully curried, brushed, and washed. These latter consumed in the seven weeks less food by five bushels than the other three, and yet, when killed, weighed more by 2 stone 4 lb. on the average.'

"It should be the duty of some one person to keep the skins of the pigs put up to fatten—indeed, we would rather say of all the pigs kept—perfectly free from mud, dust, or filth of any kind; and this will best be done by taking care that they always have clear water to bathe in within their reach, clean litter to lie upon, are occasionally combed and brushed, and that the sty is always kept free from filth. Nothing is so likely to engender lice and disease of the skin as for it to be suffered to remain in a dirty state. It is true that the maintenance of cleanliness will cost some trouble and expense, but every owner of pigs will best consult his own interests by attention to this point."

The Fattening Period. "The best period for fattening pigs is the autumn; then almost every kind of food is to be had in plenty, as well as in perfection; the weather is neither too hot nor too cold; and the humidity generally prevalent at this season acts beneficially upon the skin and tissues, and, as it were, lubricates the whole animal economy. Besides, they are ready to be slaughtered at the period when this can be done with most advantage, when the lowness of the temperature allows more time and consequently enables the owner to turn the flesh to the greatest advantage; whereas in hot weather the meat must be salted or pickled, eaten or disposed of immediately, or it turns off and is spoiled. In the immediate neighbourhood of large towns alone will it be found advantageous to fatten pigs so as to have them ready to kill in the summer; there the prices which can often be obtained may compensate the dealer for the difficulty and risk he undergoes; but even the facilities afforded by railways will hardly do this to those who reside in remote localities, as here the expense of the transit has to be added to the other items and the risk is increased by close packing."

The conditions which are so well described by Youatt obtained in his day and indeed to a much later period. It was only towards the end of the nineteenth century that the application of refrigeration to bacon-curing altered the whole practice and so made it possible to cure bacon at any time of the year.

The Best Kinds of Food. Youatt goes on to say that the best kinds of food for fattening pigs are:

Milk or whey mixed with barley-, oat-, corn-, or pea-meal, or with boiled and mashed potatoes.

Potatoes and rice; potatoes and meal of any of the above kinds or mashed potatoes and whole grain.

Peas given whole, or crushed, or in the form of soup, and either alone or mixed with barley-meal or potatoes.

Carrots and parsnips, and especially boiled carrots, which some persons consider to be the most nutritious and fattening food that can be given to swine.

Pasturage on clover, lucerne, or sainfoin, or a run in the stubble of cornfields immediately after the crop has been cut and got in.

Pig-breeding in Wigtownshire

The young pigs are here seen clustering under steam-pipes for warmth.

Beetroot and ruta-baga are good, but should only be given when other roots cannot be easily obtained.

And lastly, grain itself, as corn, barley, and oats, but not rye.

A Danish authority, Mr. Docent Fjord, some years ago laboriously investigated the comparative values of separated milk and ordinary milk as pig-feed.*

The translator of Docent Fjord's work, Mr. R. H. Beamish, states:

"The comparative values of separated milk and ordinary skim-milk have been solved for some time past by the Danes, with the result that the former is extensively used without any fear of ultimate danger.

"We may observe that the practical results derived from these trials are divided into three parts:

"(*a*) 1 lb. of separated milk is equal to 2 lb. of whey.

"(*b*) 1 lb. of barley can be substituted for 1 lb. of rye.

"(*c*) 1 lb. of barley can be substituted for 6 lb. of separated milk or 12 lb. of whey.

"That is to say, that one gallon of separated milk is equal to $1\frac{3}{4}$ lb. of barley or rye. By other form of comparison the same facts may be rendered somewhat more intelligible:

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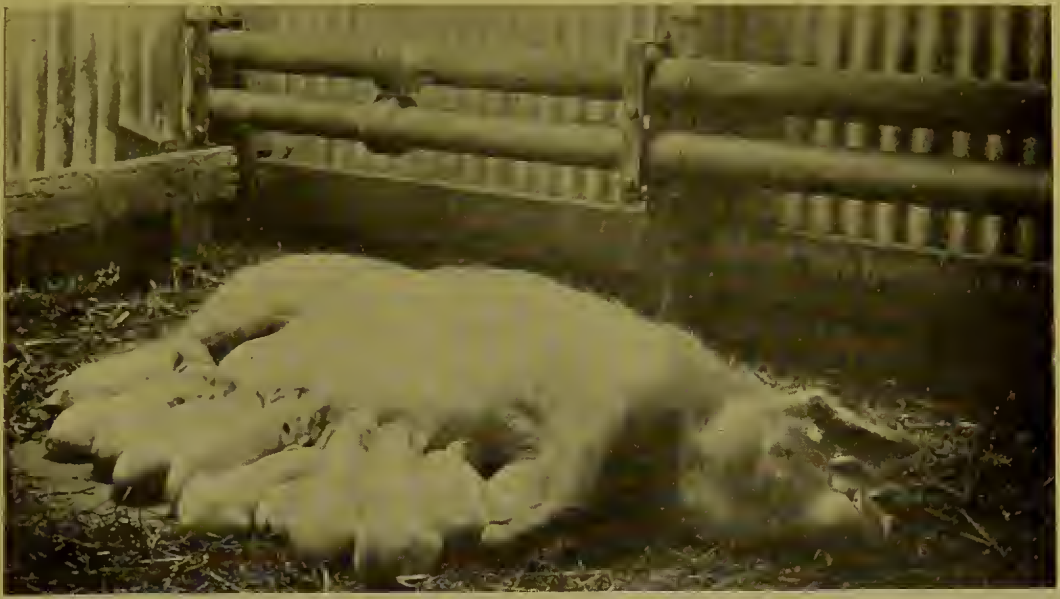
* "Pig-Feeding: being a series of comparative experiments between nutritive values of separated milk, whey, and corn." By Docent Fjord. 1895.

"Barley at	4*s.*	per cwt. is	equal to	separated milk at	¾*d.*	per gallon.
,,	5*s.* 5*d.*	,,	,,	,,	1*d.*	,,
,,	8*s.* 1*d.*	,,	,,	,,	1½*d.*	,,
,,	10*s.* 10*d.*	,,	,,	,,	2*d.*	,,

"At the same time, it must be observed that evidently the Danes do not depend upon the exclusive use of either milk or corn, but feed them in combination. During these experiments the animals were given from one to one and a half gallons of separated milk combined with from 2½ to 5 lb. of corn, according to the size of the pigs and the period of fattening.



Pig-breeding in Wigtownshire: The Rearing of the Young Pigs *

"Barley is the principal form of corn in use, though wheat, maize, and rye are also given.

"The average increase of weight from the combination of separated milk and corn has varied between ¾ and 1 lb. per diem."

Profitable Pig-feeding in Scotland. As an instance of how pig-feeding is conducted profitably in Scotland, reference may be made to a successful piggery, which has been built up during recent years by the Scottish Co-operative Wholesale Society, at Bladnoch, in Wigtownshire. The director of that establishment, Mr. Robert Green, has devoted considerable time to the subject of pig-breeding, and summarises his experience as follows:

"The first two or three years of Bladnoch Creamery's Piggery were a failure. Swine-fever broke out on four different occasions, causing very heavy losses, as the Board of Agriculture at that time had ceased paying compensation for swine-fever, as they were wont to in former years. The pigs in most cases were imported from the English

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* We are indebted for the series of photographs illustrating Pig-breeding in Wigtownshire to Mr. James Stewart, Pollokshields.—Authors.

Pig-breeding in Wigtownshire: Outside View of the Sties

and Irish markets, and it always seemed that when the stock was got to full strength this disease broke out. The society came to the conclusion that if pig-feeding was to be a success they must breed their own stock, and thereby lessen the danger of this disease. They started with a few sows at Bladnoch, but they soon found out that the breeding and fattening must be entirely separate institutions. Ground for another creamery was feued about ten miles from Bladnoch, at a place called Whithorn. As luck would have it, a small farm was also to let, and this was leased by the Scottish Co-operative Wholesale Society, where they have built a piggery for breeding purposes. A start was made with a herd of about thirty sows. This was soon found to be insufficient to keep Bladnoch piggeries stocked, so additions were soon made, and at the present time there is another addition in progress and about seventy or eighty sows are kept. Breeding was fairly successful the first year or so, and young pigs thrived fairly well when on the sow, but when they were weaned it was then that a large death-rate had to be encountered. The first step in the right direction was putting roof-lights in the houses. This had a beautiful effect on the young pigs, whereas before no light was admitted, except by the doors. In the winter time the young pigs did not seem to thrive very well, especially when the weather was very cold. Then a heating apparatus was introduced in the form of a boiler and hot-water piping. This resulted in a most important discovery. The young pigs seemed to thrive and grow after the heat was introduced, and again the death-rate was very much reduced."

Cod-liver-oil for Young Pigs. "Another important element in cold weather had to be contended with. The young pigs started to cripple, and, to try and prevent this, a cod-liver-oil emulsion was introduced in the feeding, with good results, and no cripples have appeared this winter. Some breeders find that young pigs do better when, after being weaned, they are allowed to have their liberty in a park or enclosure, with a shed erected for shelter at night. We, on the other hand, find that young pigs thrive much better when shut up with an occasional run-out. The herd at Whithorn is composed of large whites, Suffolks and Berkshires, but we find that the hardiest and best pig is got from a cross between a large white sow and a Suffolk boar. Good litters are also more numerous than with other herds, at least we find it so. Young pigs are kept on the sow from four to six weeks ; we have weaned them at four, many a time, but the average is five. Sows, when not at their work, are kept running about in a space of about six acres, and brought in and get some good food about three weeks before they are ready for pigging. The sows during summer get nothing but whey ; this is when they are not at work, and they seem to thrive well on it. The young ones, after being weaned, are fed on fine thirds and bran, with a little milk mixed amongst it. Our average litter of young pigs is about nine ; in some cases a sow has five, but very few. We have had as many as twenty in a litter."

Results of Experience. " Since starting breeding we have been fairly successful, but the chief discoveries for young pigs we have made are plenty of light, plenty of heat, and oily food—especially in the cold weather, when young pigs are so apt to get it on their lungs, which causes a severe cough and many deaths.

" Out of our herd of eighty sows we have not a cross one, they are all very quiet. Another very curious fact in connection with pig-breeding : In going through the houses you can see, when the sows are giving the young ones a suck, that there is always a pig larger and fatter than any of the others in the litter, and the curious fact about it is, that this one makes it a point to secure the teat next to the heart. I don't know what special charm is in it, but nevertheless it is true.

" Six boars are kept at the piggeries, which include the following breeds : Tamworths, Large Whites, Middle Whites, and Suffolks. Scour often breaks out amongst the young pigs when on the sow, and in most cases this happens with a sow which is in a fat condition. The milk must be stronger at any rate ; a fat sow does not make so good a job of her offspring as a lean one. The scriptural proverb *re* ' the sow returning to her wallowing in the mire ' does not suit the sow of the twentieth century, for cleanliness is one of the most important factors in pig-breeding."

Pig-breeding in Wigtownshire : Feeding the Pigs

A Fair Example of Farming. More recently, however, than the foregoing, there has appeared in the *Scottish Farmer*, during 1909, a series of articles by Mr. G. A. Bruce on the breeding and management of pigs, and one of the summaries which he gives is a fair example of what farming may arrive at :

"A herd of from sixty-five to seventy pigs of various ages consumes a ton of mixed meals per week, costing about £6 per ton, or about 2*s*. per head per week. A breeding sow can live on grass alone for three months after service, but it is an insufficient diet on which to expect her to do justice to her embryo pigs. It is better to supplement the grass with one feed of from three to four pounds a day, costing a trifle over 1*s*. per week. For a month before farrowing, and during the eight weeks following, her dietary will be a more expensive one, and will amount to 3*s*. 6*d*. per week. It is difficult to estimate the exact cost of the food consumed by a sow while nursing, as it consists largely of waste from the house and dairy, which is of little market value. The bill for her whole year's food will amount to about £6, including grass in summer, roots and vegetables in winter. A breeder near town, who has no land of any kind, but buys all his pig-food in Aberdeen, keeps his sows at an average cost of £4 5*s*. each per annum. My own sows cost rather more, and average about £6 yearly. In return for this outlay each sow will give two litters, and nurse them until they are eight weeks old. At that age the youngsters ought to sell in an ordinary market at 16*s*. to 17*s*. each. Seven or eight pigs at that money will pay the keep of the sow for the twelve months. With quite ordinary luck she should rear at least eight in each litter. In other words, with fair success and reasonable prices, the food bill of the sow for the whole year will be paid by the returns from one of her litters, leaving the second for profit : less the price of the food consumed by the piglings while with the dam, and a small charge for attendance and the upkeep of the boar, as his expenses have to be borne by the receipts from the young pigs. Bedding is more than compensated for by the manure produced." *

How the Boar should be treated. Following upon these instances may be given an extract from an excellent work by Professor George E. Day,† who, in speaking of feeding and management, says that the age at which a young boar may be first used depends largely upon his development. Some young boars may be used to a few sows when not more than seven months old, without apparent injury. As a rule, it is safer not to use a boar before he is eight months old, and to use him as sparingly as possible until he is a year old. No hard-and-fast rule can be laid down, and the owner must use his judgment in the matter.

The quarters for the boar should be roomy, clean, and well ventilated, and he should have an outdoor lot in which to take exercise. Some boars are very active, and will take plenty of exercise in a comparatively limited space. Others are lazy and inclined to become too fat. With such boars it will be found beneficial to force them to gather a good part of their living from pasture. In fact any boar will do better if he has a pasture lot, with plenty of shade available, during the summer.

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* The *Scottish Farmer*, August 21, 1909.

† "Swine." A Book for Students and Farmers. By George E. Day, Guelph, Canada.

The food for the boar should be varied, nutritious, and moderately bulky. Succulent foods, such as roots in winter and green food of some kind in summer, should always be fed with his meal ration. Succulent foods are necessary to keep him in good health. Finely ground oats are very suitable for the main part of his meal ration. An equal weight of middlings, or middlings with bran, added to the oats, makes a good combination. Small proportions of other kinds of meal may be added if desired. Secondly, crop-clover or alfalfa-hay, cut up finely, steeped in water and mixed with the meal, makes a good mixture to give variety to his ration. He should be fed only on what he will eat up clean ; and if he is inclined to become fat and lazy, the amount of food should be reduced.

The boar should not be permitted to serve a sow more than once, and should not be allowed to run with sows to which he is to be bred. These practices tend to exhaust the boar, and are likely to result in small, weak litters if persisted in. The aim should be to save the boar from all unnecessary service, especially during the heaviest part of the season.

Feeding and Management of the Sow. A sow should not be bred from before she is eight months old, and in many cases it is better to delay breeding two or three months longer. The development of the sow will influence the breeder in this matter.

During the period of gestation, sows of all ages should have abundant exercise. In summer, pasture should be provided for them, in which there is plenty of shade. They should also be given plenty of water, especially during hot weather. For pasture, alfalfa and clover are among the best. At certain seasons, rape is excellent. A permanent pasture of mixed grasses, especially if it contains numerous shade-trees or is partially wooded, makes an excellent run for sows.

Winter management is more difficult than summer. The greatest difficulty is to give the sows sufficient exercise, without which good litters cannot be expected. In many cases they can be given the run of the barn yard, where they will take exercise, rooting among the manure or working among scattered straw or chaff, to find what little grain it may contain. If a dry, well-bedded sleeping-place is provided, which is free from draughts, the conditions are almost ideal for the present results. When it is impossible to use the barn yard, a roomy shed with earth floor and a sleeping-pen arranged in one corner can be made to answer the purpose. By littering the shed with cut straw or chaff, and sprinkling a very little whole grain among the chaff every day, the attendant can get the sows to take considerable exercise. Another method is to make use of small portable pens set in outside lots. These pens may be made 8 ft. wide, 16 ft. long, 7 ft. high in front and 3½ ft. high at the back, with shanty roof. The pens may be made of a single thickness of inch-boards with battens over the cracks. In the front is placed a window, and an opening near one corner large enough for the sows to go in and out. No door is required for the opening. These pens should be placed facing the south, and about fifty yards from the feeding-place. If kept well bedded, and banked about the bottom on the outside with horse-manure, they afford quite comfortable sleeping-quarters. The sows are forced to take exercise in walking backwards and forwards between the pen and the feeding-place. A pen such as described will accommodate nine or ten sows, though it is better, as a rule, not to have more than five or six sows together. Care should be taken to provide plenty of trough room ; and the troughs should be located on high, dry ground, or a platform should be made on which to place them.

The Sow and her Young. A record should be kept of the date of service of each sow, so that the date of farrowing will be known in advance. The normal period of gestation is 112 days, though they very frequently run a day or two over this time. A week or ten days before she farrows, the sow should be placed in the farrowing-pen, so as to become accustomed to changed conditions before farrowing. She should still be encouraged to take a moderate amount of exercise, however.

The pen should be provided with guard-rails, made of 2 × 8 in. planks fastened with the edges against the side of the pen about 10 in. from the floor. These prevent the sow from lying against the partition, and lessen the danger of injury to the little pigs, which often find the space under the guard-rail a very convenient refuge. A little cut straw makes the best bedding, as the little pigs are apt to become entangled in long straw, and find difficulty in keeping out of the way of the sow when she moves about. The sow should be handled, more or less, before she farrows, so that she may become accustomed to the presence of the attendant in the pen. A sow treated in this way is less likely to become irritable and excited when the attendant enters the pen after she farrows. If everything goes well, she will require but little attention after farrowing, and the less she is interfered with the better, except when it is absolutely necessary.

Many sows will take the boar a few days after farrowing. To breed a sow at such a time is bad practice. No sow can do justice to herself and two litters of pigs at the same time. Usually the sow may be bred again a few days after her pigs are weaned, if not too much pulled down in condition by nursing. If she has raised a large litter and is very much emaciated, the chances are that she will produce a very small litter the next time if she is bred immediately after the pigs are weaned. In such instances, she should be given three weeks or a month of liberal feeding to enable her to regain her lost strength and vitality before she is bred. Many a man has been puzzled to know why his sow, which has raised a large litter, should drop down to four or five puny pigs the next time. The reason is not difficult to find. To produce a large, vigorous litter, the sow must be strong and full of vitality at the time of service.

How to feed the Breeding Sow. In feeding the breeding sow during the period of gestation, the feeder should aim to keep her in good, strong condition without having her become extremely fat. Many farmers go to the other extreme and keep their sows thin, and the thin sow will either not do justice to her pigs or will become a mere wreck herself during the time she is nursing her litter—in fact, the chances are that both these things will happen. A sow may be kept in fairly high condition and still produce satisfactorily, provided she takes plenty of exercise.

When on good pasture, sows require very little meal. In this matter the feeder must be governed by the condition of the sows, and if he finds that they are falling off in condition, it will pay him to increase the feed. Ground oats, mixed with wheat, bran, or middlings, make a good ration for sows. It is well to avoid the heavier and more heating kinds of grain, especially during hot weather. In cold weather, when the sows take a good deal of outdoor exercise, more heating foods, such as corn, peas, or barley, may be used more freely, but always in moderation. In those sections where corn is abundant and cheap, there is a temptation to use it more exclusively, a practice which cannot produce the best results. Wheat, bran, and middlings are available in nearly every district, and will be found profitable to mix with corn for breeding sows. The liberal use of pasture or green feed in summer, and of roots and clover or alfalfa-hay in winter, as described under the feeding of the boar, is always in order, and will help to ameliorate the injurious effects of corn-feeding. When sows are fed outdoors in cold weather, it is better to feed the meal dry. They will require very little water outside of that supplied by the roots. If roots are not available, water must be supplied, and the meal may be soaked before feeding if desired. In warm weather, an abundant supply of water is very important.

In the Farrowing-pen. When the sow goes into the warm farrowing-pen it is advisable to feed the meal in the form of a thick slop, and a moderate ration of roots should be continued if she has been receiving roots before she is taken in. This system tends to prevent constipation and a more or less fevered condition, which may result from changing from outdoor life to confinement. A small amount of oil-cake or ground flax-seed added to the ration is also helpful in preventing constipation. After the sow farrows, there should be no hurry about feeding her. If she lies quiet for ten or twelve hours, so much the better. At first she should have little more than a drink. A very thin slop of water and middlings, given in small quantities, will answer very well. If the weather is cold, tepid water should be used. The food should be gradually increased, and in the course of a week or ten days she will be on full feed. A good mother with a large litter requires very liberal feeding. If the litter is small, it may be necessary to reduce the feed.

Many different rations are used for nursing-sows. A very good ration can be made by mixing two parts of finely ground oats with one part of bran and one part of wheat-middlings, and allowing the food to soak between feeds. A few roots are beneficial, and sweet skim-milk is good. The heavier grains should be used sparingly, and should be largely diluted with such foods as bran, middlings, or ground oats.

After the pigs are weaned, the food should be cut down to check the secretion of milk. Dry oats are a safe food for the sow after the pigs are weaned. If the udder gets very full, it is a good plan to turn the sow in with the pigs once a day for a few days.

Feeding and Management of Young Pigs. When the little pigs are born, the attendant should be on hand to see that everything goes well. If the pigs are strong and the sow lies quiet, it is better not to interfere. If the pigs seem somewhat weak, or the sow is restless, it is safer to place them in a well-bedded box or basket to keep them out of the way until all are born. If the pen is chilly, a bottle of hot water placed in the bottom of the box and covered with a blanket, with another blanket over the top of the box, will help to keep up the vitality of the pigs. The little pigs should be placed on the mother to suck as soon as possible. As soon as the sow appears to have settled down quietly, it is best to put the little pigs with her and leave them together. It is not well to interfere, except when it is absolutely necessary.

By the time the pigs are about three weeks old they will have learned to eat. If at all possible, they should be given access to another pen, in which is kept a small trough. Here they can be fed on a little skim-milk with a very little middlings stirred into it. The quantity of middlings can be gradually increased as the pigs grow older. If they can be taught to nibble at roots during this time, all the better. A little whole wheat, or soaked corn, scattered on the floor of the pen, will cause them to take exercise while hunting for it. If it is not possible to provide an extra pen, it will be necessary to shut the sow out of the pen while the little pigs are being fed. Exercise is very important for young pigs, and every possible means of securing it should be adopted. If they are kept in a small pen with the mother, some of the best of them are apt to become too fat, and are likely to sicken and die. Pigs that come in the spring and early fall are more easily managed than winter litters, as they can be given outdoor exercise. If the sow is turned out with her pigs, it is not well to give her a large range, as she is likely to travel too far and tire the pigs too much.

The Weaning Period. There is a great deal of difference of opinion as to the age at which pigs should be weaned. Some breeders advocate leaving the pigs with the sow for ten or twelve weeks ; in fact, the sow is practically allowed to wean her own pigs. For producing show pigs, this method is, no doubt, a very good one, but it practically means only one litter a year ; at any rate, it does not admit of two litters a year. A good sow, properly cared for, should produce two litters a year, and the average farmer will find it more profitable to wean his pigs early enough to permit two litters to be raised. If the young pigs have been taught to eat as described, and skim-milk is available, they may be weaned successfully when six weeks old. If skim-milk is not available, it is better to defer weaning two weeks longer. Skim-milk and middlings make about the best food for young pigs at this time. The middlings are better soaked for a few hours before feeding, or, better still, scalded. If fed freshly mixed they are likely to cause indigestion. Scalding the middlings is especially useful when no skim-milk is to be had, as it makes the food more palatable. To scald the middlings, it is best to pour boiling water on them, cover the vessel, and allow to stand several hours, or from one time of feeding until the next. A few finely ground oats added to the middlings will be found beneficial. If the oats are not very finely ground, it is better to sift out the coarsest hulls. When the pigs are first weaned, they should be fed at least four times a day, being allowed only what they will eat up clean before leaving the trough, and great care should be exercised in keeping the trough clean. When well started, they may be changed to three feeds a day.

Table of Composition of Feeding-stuffs

Showing the number of pounds of digestible Nutrients contained in 100 lb. of the Feed-stuffs named.

Food-stuff.	Water.	Ash.	Protein.	Carbo-hydrates.	Fat.	Nutritive ratio.
	Lb.	Lb.	Lb.	Lb.	Lb.	
Corn	10.9	1.5	7.9	66.7	4.3	1 : 10
Gluten meal	8.2	.9	25.8	43.3	11.	1 : 3
Barley	10.9	2.4	8.7	65.6	1.6	1 : 8
Oats	11	3	9.2	47.3	4.2	1 : 6
Rye	11.6	1.9	9.9	67.6	1.1	1 : 7
Peas	10.5	2.6	16.8	51.8	.7	1 : 3
Buckwheat	12.6	2	7.7	49.2	1.3	1 : 7
Wheat	10.5	1.8	10.2	69.2	1.7	1 : 7
Wheat-bran	11.9	5.8	12.2	39.2	2.7	1 : 4
Wheat-middlings	10	3.8	12.8	53	3.4	1 : 5
Linseed-meal (new process)	10	5.2	28.2	40.1	2.8	1 : 2
Clover (green)	70.8	2.1	2.9	14.8	.7	1 : 6
Alfalfa	71.8	2.7	3.9	12.7	.5	1 : 4
Rape	84.5	2	1.5	8.1	.2	1 : 6
Sugar-beets	86.5	.9	1.1	10.2	.1	1 : 9
Mangels	90.9	1.1	1.1	5.4	.1	1 : 5
Turnips	90.5	.8	1	8.1	.2	1 : 9
Artichokes	79.5	1	2	16.8	.2	1 : 9
Potatoes	78.9	1	.9	16.3	.1	1 : 18
Skim-milk	90.6	.7	2.9	5.2	.3	1 : 2
Buttermilk	90.1	.7	3.9	4	1.1	1 : 2
Whey	93.8	.4	8	4.7	.3	1 : 7

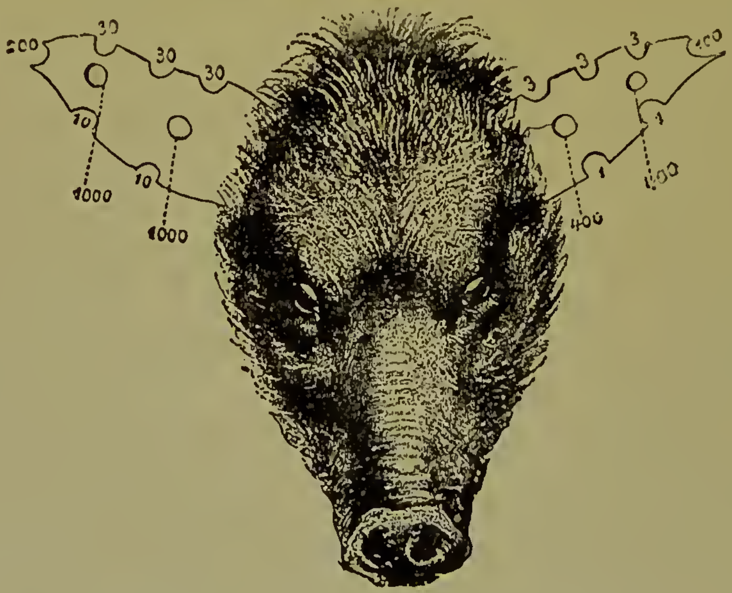
The Best Kinds of Grain. When the pigs are three months old, a little ground barley or small quantities of other grain may be added to the ration. At first the barley, or other grain, should constitute not more than one-fifth of the total ration, and it can be gradually increased as desired. Barley is one of the very best kinds of grain upon which to start young pigs, though other grains may be used. The almost exclusive use of corn cannot be too strongly condemned, as corn is a poor bone- and muscle-former. It is important to teach young pigs to eat a few roots as early as possible ; or, if it is too late in the spring for roots, some form of green food should be supplied every day.

If the young boars are not intended for breeding purposes, they should be castrated before they are weaned.*

The various feeding-stuffs which are used in pig-feeding have been studied by Professor Hendry,† who has compiled an interesting table (*see* p. 149) showing the nutrients which they contain and which, in constructing a ration for pig-feeding, cannot fail to be of value to all those who are interested in this branch of the subject.

As a general principle, it may be recognised that the amount of protein required in a pig ration for young and growing animals gets gradually less as the animal approaches maturity, and this is due to the fact that flesh is added much more slowly when an animal is full grown than when during the period of growth.

Pig Population of America. In the United States ‡ the number of pigs is greater than in any other country in the world, and it is stated that in North America the pig population in round numbers amounts to 58,000,000, of which 95 per cent. are in the United States and 5 per cent. in Canada. These constitute almost half the number



SCHEME FOR EAR-MARKING PIGS BY NOTCHES

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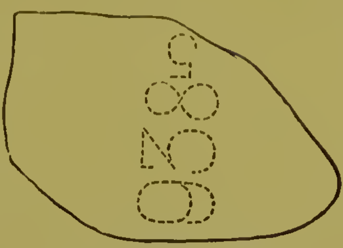
* Day.

† "Foods and Feeding." By Professor Hendry, Wisconsin, U.S.A.

‡ "Swine in America." By Coburn.



Identification Marks on Ear of Pig made by Forceps fitted with Needle-points

of hogs in the world. As we have seen, the pig population of the United Kingdom is just a little over 4,000,000. The comparison, therefore, shows that swine husbandry has been developed to an enormous extent in the United States. There also, however, as in other parts of the world, it has been found that the governing factor is the bacon-hog, and it is differentiated from a fat hog by terming the latter a lard-hog, meaning that a large quantity of the fat has to be rendered down into lard. The greatest market for hogs in the world is at Chicago, and it is stated that as many as 87,716 hogs have been marketed there on one day and more than 300,000 in one single week ; more than 1,100,000 in a month, and nearly 9,000,000 in a year. Of this latter number, about 7,500,000 were slaughtered in Chicago establishments, where it is stated that for forty-two years prior to and including the year 1907 the gigantic total of hogs slaughtered had reached 247,000,000. Some idea of the great space required for marketing such huge numbers of live-stock may be gathered from the comprehensive view of Chicago stock-yards which forms the frontispiece in Volume II.

Ear-marking Forceps for Pigs (German).

As we have already seen, the pigs in the United States and Canada differ from those in the United Kingdom ; the bacon-hog differs in many ways. They are described in a brochure issued by the Department of Agriculture of the United States, and written by Mr. William Dietrich, in the following words :

Bacon-hogs of the United States. "The bacon-hog of this type differs considerably from the English bacon-hog. There is, however, a growing tendency toward the typical bacon type. The indications point to the fact that we are at the 'parting of the ways,' and that in the future we will have a place for the ideal bacon-hog as well as for the fat- or lard-hog. Corn is at present being used for other purposes, such as the manufacture of corn-starch, whisky and oil. The latter is used for various purposes, as for lubricating, a table oil, as a substitute for olive-oil, linseed-oil, &c. This has caused the price of corn to go up to nearly what other grains used as hog-feeds are worth. At the same time, a ration of all corn, which usually forms the principal part of the feed of the fat- or lard-hog, is coming to be generally recognised as detrimental to the best development of swine from the breeder's standpoint. These things are the cause of a gradual drifting toward a more mixed ration in swine-feeding, and usually a ration containing more protein or flesh-forming material. Coupled with this, there is not so great a demand for fat pork as there formerly was, and shipping and cold-storage facilities are much better, consequently more fresh and lean meats are used. These various factors are gradually, but most surely, effecting a change in the character of swine in the United States. The all-fat hog of the past will in the future be partly replaced by the bacon-hog, and the fat- or lard-hog as a whole will, in the future, more nearly approach the bacon-hog in form than in the past. Of course there will always be a demand for lard, consequently there will always be a place for the fat- or lard-hog. But the bacon-hog will occupy a more prominent position in the future than he has in the past. There is a demand on the markets of this country from foreign countries, and more largely from the United States, for bacon, and there being few bacon-hogs to supply the demand, the trade is supplied from the lighter hogs of the fat- or lard-hog type. This bacon, however, does not command so high a price on the market as does bacon from typical bacon-hogs. The bacon-hogs under consideration here weigh from 155 to 195 lb., and range in age from six to eight months. They are simply hogs selected from the light hogs in general, that conform as nearly as possible to the bacon type. They are not very fat, have fairly good development of muscle, or lean meat, and are as long and deep inside as is possible to obtain them. About 20 per cent. of the light hogs that come to the Chicago market are of this type. They are handled on the market as

Choice bacon-hogs.
Good bacon-hogs.
Common bacon-hogs."

The Choice Bacon-Hog. "Choice bacon-hogs are the best of this class; they are hogs that show good length and depth, good quality, and are smooth, well developed, and not very fat. They are hogs that have had considerable exercise, and have not been fed on an exclusive corn ration. These bacon-hogs are selected, for the most part, from shipments that come from outside of the corn-belt, where the principal feed is similar to that used in Great Britain, Denmark, and Canada for bacon production, viz., oats, barley, rye, peas, skim-milk, and pasture. These are the feeds that are conducive to the production of the best bacon when fed to hogs of the bacon type, and when fed to hogs of the fat- or lard-hog type bacon-hogs such as we have under discussion here are produced. These bacon-hogs have more fat on the outside and less lean meat on the inside of their carcases than the typical bacon-hogs, but are better in these respects than the typical fat- or lard-hogs. In truth, this bacon-hog is an intermediary between the fat- or lard-hog and the typical bacon-hog, being more like the former than the latter.

"The good bacon-hogs of this class may be of poorer quality, may be lower in condition, or may be too fat or too much of the fat-hog type. Any one or all of these conditions would be the cause of hogs grading lower than choice.

"If there is a still more marked deficiency in these characteristics, the hog will grade as a common bacon-hog. But still this hog has sufficient quality and condition to show that he has been well bred and has been fed so that his sides will do to cure for the cheaper grades of bacon."

Market hogs, however, in the United States are subject to an analytical classification which serves to keep each style of carcase separate, so that they can be put to various uses :

THE CLASSIFICATION OF MARKET SWINE IN THE UNITED STATES

Classes.	Sub-classes.		Grades.
Prime heavy hogs, 350–500 lb.			Prime.
Butcher hogs, 180–350 lb.	Heavy butchers, 280–350 lb.		Prime. Good.
	Medium butchers, 220–280 lb. Light butchers, 180–220 lb.		Prime. Good. Common.
Packing hogs, 200–500 lb.	Heavy packing, 300–500 lb. Medium packing, 250–300 lb. Mixed packing, 200–280 lb.		Good. Common. Inferior.
Light hogs, 125–220 lb.	Bacon	England, 160–220 lb.	Choice. Light. Fat.
		United States, 155–195 lb.	Choice. Good. Common.
	Light mixed, 159–220 lb.		Good. Common. Inferior.
	Light light, 125–150 lb.		Good. Common. Inferior.
Pigs, 60–125 lb.			Choice. Good. Common.
Roughs.			
Stags.			
Boars.			

MISCELLANEOUS

Roasting pigs, 15–30 lb.
Feeders.
Governments.
Pen-holders.
Dead hogs.

The swine of the bacon type in the United States and Canada are described by Professor Day as follows :

SWINE OF BACON TYPE

Description and Scale of Points

GENERAL APPEARANCE

Size : Well developed for age	5
Form : Long, smooth, all parts proportionately developed so as to give the impression of a well-balanced, strongly built animal. Top line, strong ; under line, straight ; belly, trim and neat	10
Quality : Hair, fine ; skin smooth, showing no tendency to wrinkle ; bone, clean and strong but not coarse ; flesh, firm and smooth, with no flabbiness at jowl, fore-flank, belly, or ham	10
Condition : Well covered with firm flesh, especially along back and loin, but not heavily loaded with fat	6
Style : Active and sprightly, walking without a swaying movement and standing well up on toes. Breeding animals should show strong character	4

(*a*) *Head and neck :*

Snout, medium length and moderately fine	1
Face, broad between eyes ; poll, broad and full	1
Eyes, good size, full and bright	1
Jowl, fair width and muscular, but very neat, showing no flabbiness	2
Ears, moderately thin and fringed with fine hair	1
Neck, medium length and muscular, but possessing no tendency to arch on top	2

(*b*) *Fore-quarters :*

Shoulders, smooth, somewhat rounded from side to side over top and very compact ; no wider than back, and not running back on side so as to shorten distance between shoulder and ham	6
Breast, good width and full	3
Fore-legs, set well apart, medium length and straight ; pasterns, upright ; bone, clean and strong ; feet, medium size and strongly formed	4

(*c*) *Body :*

Back, medium width, rising slightly above the straight line and forming a very straight arch from neck to root of tail	6
Loin, wide as rest of back, strong and full, but not unduly arched	5
Ribs, good length and moderately arched	4

Side, fairly deep; long, smooth and straight between shoulder and ham; a straight-edge laid over shoulder-point and ham should touch the side throughout	8
Heart-girth, full, but not flabby at fore-flanks, filled out even with side of shoulder; there should be no tucked-up appearance back of fore-legs, nor droop back of shoulder-top	5
Flank, full and low	2
(*d*) *Hind-quarters :*	
Rump, same width as back; long and slightly rounded from a point above hips to tail, and somewhat rounded from side to side over top	4
Ham, full without flabbiness; thigh, tapering towards hock without wrinkles or folds, and carrying flesh well down towards hock	6
Hind legs, medium length; hocks, set well apart, but not bowed outward; bone, clean and strong; pasterns, upright; feet, medium size and strongly formed	4
Total	100

NOTES ON SCALE OF POINTS

Size. The feeder requires a hog which will attain market weight at an early age, and hence he requires breeding animals of good size. If a market hog is under consideration, all that is necessary is to decide whether it is within the weight limits set for hogs intended for bacon.

Form. In form the bacon type of hog is very different from the lard type. It is longer in the leg, has less thickness and depth of body, and is lighter in shoulder, neck, and jowl. Length, especially from the back of the shoulder to the ham, is very important. From the back of the shoulder to the snout the hog should be comparatively short. Some hogs are long from snout to rump, but they have such a long, deep shoulder that they are short from the back of the shoulder to the rump, as compared with the distance from the same point to the snout. Such hogs carry too much weight at the cheap end of the side of bacon, and hence are very objectionable, and the judge must be careful that he is not deceived by this conformation. But, along with length, the hog must possess sufficient depth and thickness of body to denote constitution. No matter how long a hog may be, if it has long coarse legs, and a narrow, cramped chest, it is an undesirable type to breed from. The breeder must secure reasonable depth and thickness of body in order to have a hog of strong constitution, even though he may have to sacrifice a little length. This point must not be lost sight of in judging breeding animals. A trim belly is required, because the belly meat is cheaper than the part above it. Allowance would have to be made in this connection for a sow that had produced several litters of pigs. It would not be desirable to have her as light in the belly as a boar or a market hog.

Quality. A fine, smooth coat of hair denotes thriftiness and good quality of flesh. A " swirl " or " rose " in the hair on the back is objected to mainly on account of appearance. Wrinkles on the skin, if at all marked, indicate coarse-grained flesh. Softness and flabbiness of flesh denote too much fat in proportion to lean. The bone is an extremely important indication of quality, and is judged by the appearance of the bone in the legs. The bacon type of hog has heavier bone than the lard type, because there is a relation between the development of bone and muscle. Very fine bone is usually associated with an excessive development of fat, and therefore it is undesirable in a bacon-hog, where a large amount of lean in proportion to fat is the object sought. On the other hand, very coarse, puffy bone denotes poor quality of flesh, and is often associated with hard feeding qualities and late maturity. The right kind of bone is somewhere between these two extremes. It should have good weight, but the legs should present a very clean-cut appearance. A round, puffy-looking leg should not be tolerated. In the boar, it is difficult to have too heavy bone, as long as it is clean cut, that is, not covered with a coarse, puffy skin. The sow, however, should have much finer bone than the boar, but it should be in proportion to her size and frame.

Condition. To be able to judge of the proper condition for a market hog requires considerable practice in examining animals both before and after they are slaughtered. It is customary to show breeding-animals in considerably higher condition than would be desirable in a market hog, but the over-fatting of breeding-animals for show should be discouraged by the judge.

Style. The bacon type of hog is an active animal, and if it is properly formed and has the desired development of muscle it will be able to walk off without apparent effort. Some hogs walk with a writhing movement, which is a sure indication of some serious weakness.

Snout. Length of snout varies with breed. Very often, however, a long snout is associated with a narrow chest, and a very short snout is often associated with a heavy jowl and neck.

Face. A broad face and a broad poll which comes well forward indicate good constitution and feeding qualities. The poll is the upper portion of the skull.

Eyes. Large, full, bright eyes indicate good health and constitution.

Jowl. The jowl has very little market value. A heavy, fat jowl denotes a tendency to put on too much fat. Good width across the jowl is desirable, but it should be trim and neat. A narrow jowl is often associated with a narrow chest and poor feeding qualities.

Ears. The ears are an indication of the general quality of the animal. Thick, coarse ears indicate coarseness and thickness of skin, which, in turn, is associated with coarse-grained flesh. Size of ear varies with breed, and a large ear is not necessarily coarse.

Neck. A long, scrawny neck indicates weak constitution and slow feeding qualities. On the other hand, a short, thick neck, with an arch, or crest, of fat on the top, will cause the side of bacon to be heavy at the shoulder and neck end, and, as was pointed out, this is the cheap end of the side of bacon. Of course a mature boar has a heavier neck than a sow or barrow, and it is desirable that he should have a strongly muscled neck. An excessive development of crest, however, is undesirable.

Shoulder. The shoulder of a bacon-hog is somewhat upright, making the animal comparatively short from the back of the shoulder to the snout, and long from the back of the shoulder to the rump. Owing to its being a comparatively cheap part, it should not be largely developed. It must be remembered, however, that a little extra width of shoulder is not nearly so objectionable in a breeding animal as a narrow chest. In the boar the shoulders are heavier than would be desirable in a sow or a market-hog, and as he grows older "shields" develop on the sides, which give the appearance of roughness. The shoulders should be very compact on top, however, and should blend well with the top line and the rib at this point.

Breast. The breast should be wide, to indicate a large chest cavity, and hence plenty of room for heart and lungs.

Legs. Strong, upright pasterns indicate good quality and strength of bone.

Back. A sagging back, or an unduly arched back, indicates a weakness of muscling, and consequently a lack of lean meat along this valuable part. The arch in the back should be very slight, the highest point being over the loin. A very wide back denotes excessive fat, and a very narrow back a lack of flesh or lean meat.

Loin. The loin is the most valuable part of a side of bacon, and therefore should be strongly developed and well packed with flesh.

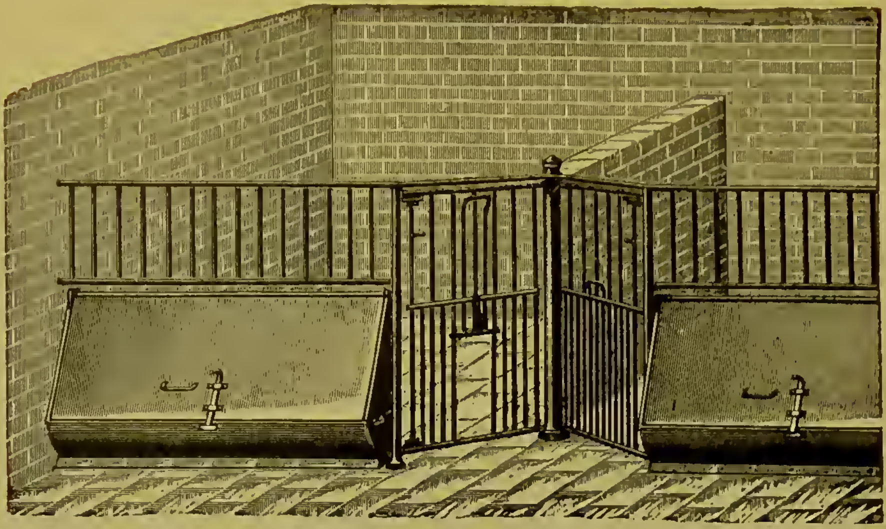
Rib. The spring of the rib in a bacon-hog is very characteristic. It should arch out boldly from the backbone, then suddenly drop in an almost vertical direction, giving a flat, straight side. This point should receive especial attention in judging, as it is a sure indication of a large development of muscle along the back.

Side. From a packer's standpoint, a pig cannot have too long a side. Extremely long legs, however, are inclined to be narrow and shallow-bodied, and to lack constitution. The breeder, therefore, must exercise care in this matter, and while he wants good length, he must be careful not to secure it at the expense of constitution. It is well to avoid extremes of all kinds.

Heart-girth. A large heart-girth indicates constitution. The judge must be careful that he is not deceived by a padding of flabby fat in the region of the fore-flank, which will give the impression of a greater thickness through the heart than the animal really possesses.

Flank. When the flank is reasonably well let down, the flesh is usually well carried down on the ham. Fulness of flank indicates thick, fleshy belly-meat.

Rump. The rump affords a valuable cut. A flat, broad rump



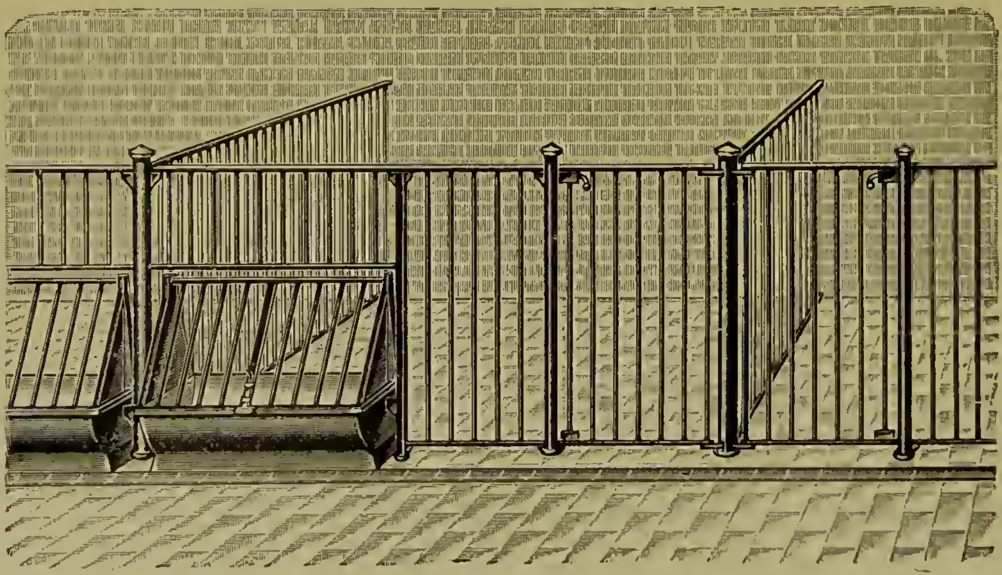
A Well-designed Pig-sty, Trough covered

indicates the presence of too much fat. It should be the same width as the rest of the back, but no wider.

Ham. Great, broad, bulging hams are not wanted in the bacon-hog. Such hams carry a great deal of fat and require severe trimming in preparing the side of bacon for market. The ham of the bacon-hog is smooth and firm and tapers towards the back. The flesh should be carried well around the bone, leaving no bareness of bone on the inside of the thigh. A ham which bulges on the outside, but is bare on the inside of the thigh, is very objectionable.

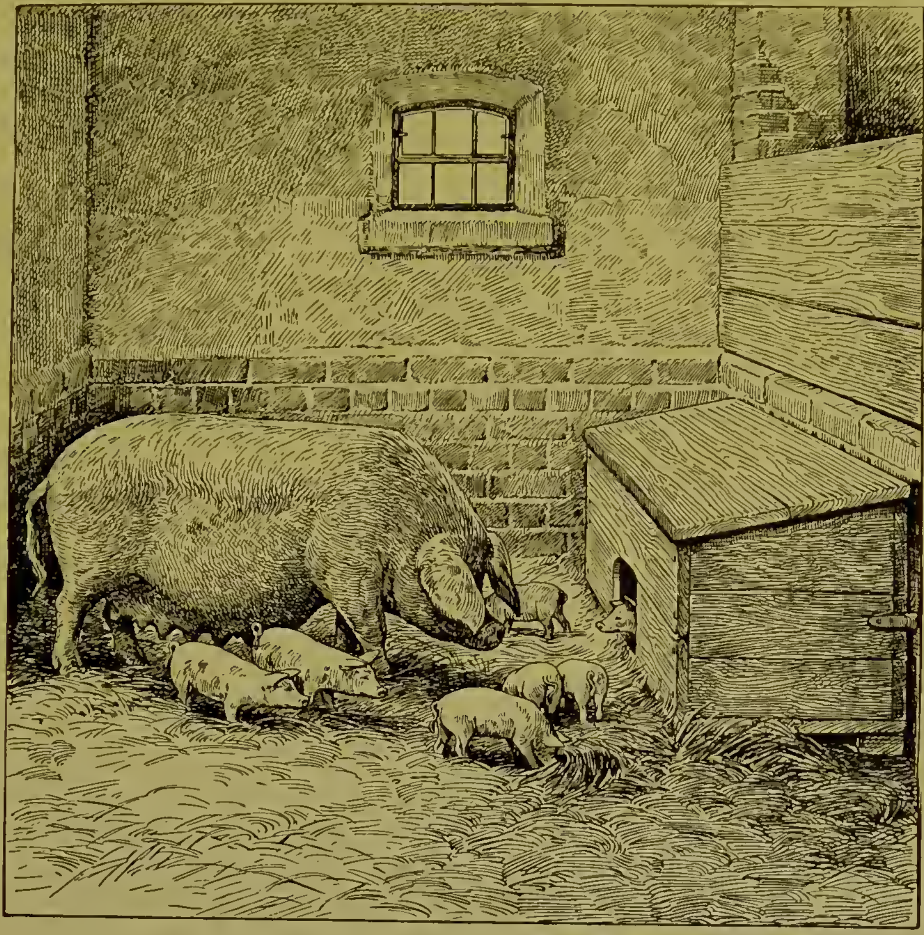
PIG-STIES

The construction of pig-sties is comparatively an easy matter, but it must be borne in mind that it is necessary always to provide plenty of ventilation and to keep the animals warm, more especially in winter-time.



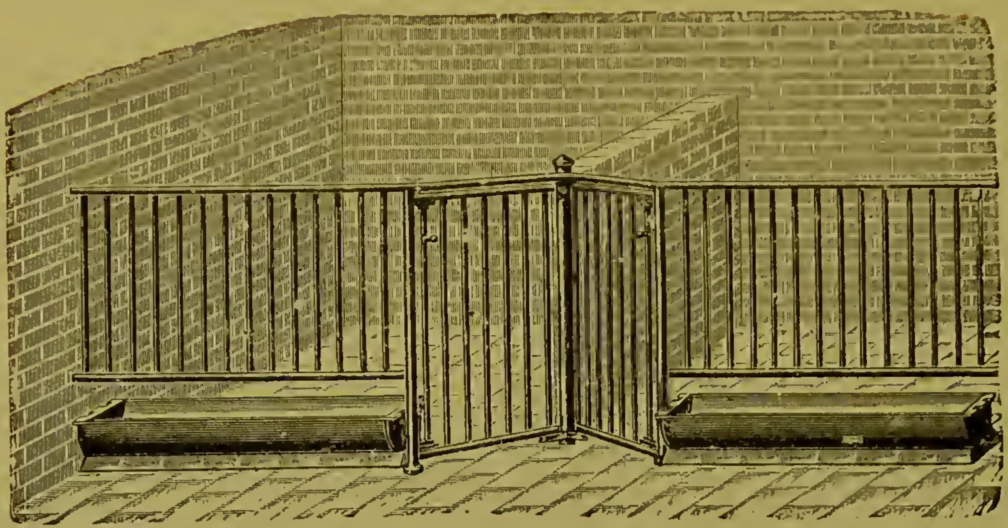
Pig-sty ; Trough Open or Exposed

Drainage should also be well attended to, and the floors should be of impervious material. "The importance of having sound, healthy and suitable housing for pigs is," says a leaflet issued by the Board of Agriculture, "overlooked, or not understood, by a very large number of pig-owners, many of whom can least afford to waste their money by uneconomical methods. Many members of the working classes, and not a few farmers, by bringing up the animals in cold, damp, and dirty surroundings, are actually throwing away a great part of their labour and trouble, and even running the risk of losing the swine altogether. It is the foul, badly built sty, which in bad weather becomes a quagmire, which harbours the germs of disease that too often spreads through the neighbourhood and cannot be suppressed for years. But even where no actual disease appears, all experience shows that swine kept under good conditions thrive better and fatten quicker than those kept in filthy surroundings. The labour and expense of building a good sty, and of keeping it properly, are repaid in a very short time.



Pig-sty with Protection for Young

"Before laying down any rules about how to go to work, the different circumstances under which pigs are kept must be considered. Some pig-owners live in urban centres where ground is valuable and in demand, not only for gardens and allotments, but also for building houses. It is



Pig-sty with Unprotected Open Trough

obviously useless to build an expensive sty on land which is likely to be used for other purposes in a short time. Other owners live in country places where land is plentiful, but building material scarce and troublesome to get. In such cases the owner must use what he can find. Sometimes stone is easily procured, sometimes bricks and sometimes neither. The size and kind of pig-house must depend on the class of pig-rearing that is practised in the district, and the plans must be adapted to meet the different requirements of breeding or fattening. If the pig-owner lives in a dairying county, a wheat-growing district or a potato-growing centre, he must modify his plans to suit the wants and customs of such a neighbourhood ; he must not think, for example, of putting a Large White Yorkshire sow into a sty which would be just suitable for one of the small breeds."

Points to be observed. " In every case the man who sets about building a sty must aim at getting as much sunlight, fresh air, and dry footing as he can, and, if circumstances make it impossible for him to get all three requirements, he had better not build the sty at all.

" The simplest way of dealing with the question of how to build useful, sound, and cheap housing for pigs is to begin with the case of the workman or labourer who, for varying reasons, has only need for one sty, and to lead up from this to a description of a more elaborate piggery where many swine—and those of all ages and sizes—are kept, and where the expenditure is a somewhat less serious consideration.

" (1) The most important part of every sty is the *floor*, and every effort should be made to see that this is in all respects satisfactory, even if the rest of the building has to suffer a little. Swine can keep healthy and grow fat in a poor house if the floor is well made, but there is great danger of their pining and falling sick on a cold, damp floor even if they have a magnificent roof over their heads. A broken floor in which puddles of rain-water or urine can lie is a breeding-place for sickness and parasites of all sorts ; moreover, it gives the pig an opportunity of rooting, which he will generally be prompt to do, often not stopping till nearly the whole of the floor is upturned. The floor, therefore, must be made of some hard substance which is not brittle and does not too readily break up. The best material for this purpose is concrete or Portland cement, though a useful flooring may also be made with a mixture of tar and gravel, stamped and rammed into a solid block. Care must, however, be taken in this case not to let it be too long exposed to the sun's rays lest the tar melt and make the whole surface soft. Bricks cannot be recommended unless they are new and unbroken, and are laid in cement at least six inches deep, and even then they are liable to chip and crack. Stone flags are bad, as the manure sinks in between the joints and makes the soil beneath impure, while wooden floors, unless movable, are wholly to be condemned as dangerous and mischievous in the last degree. Concrete should therefore be used whenever possible."

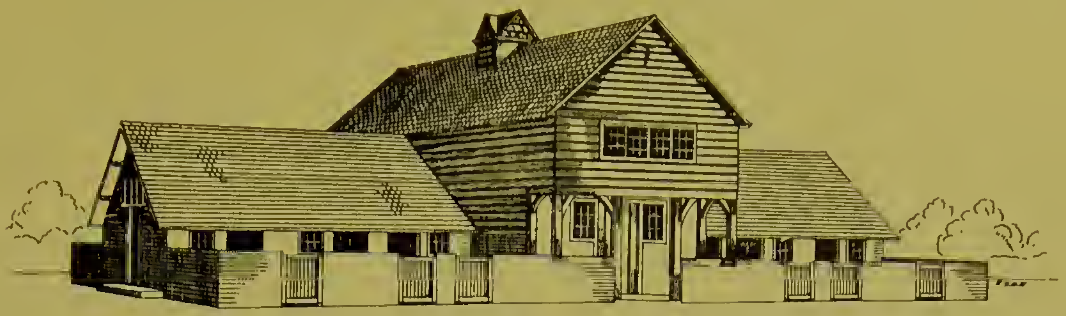
The Value of a Concrete Floor. "The preparation of a concrete or cement floor is well within the means of every workman who can afford to buy a pig, and it is not difficult to make. It should be laid with a gentle slope towards the front of the sty, and it is advisable to make the top of the outer court lower than the bottom of the inner court by about two inches. There will thus be a small step between the two courts, which will enable drainage water to fall with a rush and run away more

Pig-sty with Protective Rail for Young

rapidly. The object is to secure dryness under foot, for, as has been already said, this is not only more healthy for the pig, but it helps to keep the floor from splitting or breaking away. Small channels should also be made in the cement before it has hardened, and these should run diagonally, in parallel lines, and not cutting across each other in the way that is termed cross-hatching. These diagonals or sloping lines should run from right to left in the inner court, and from left to right in the outer court. The reason for this will be given later on. Before leaving this subject it is as well to emphasise this point: the slope of the floor should not be so great as to make it slippery, lest the pigs on running out to their food should hurt themselves, and for the same reason the surface of the cement between the channels should be left slightly rough."

Building the Walls. "(2) The next point to be considered is that of the *walls*. These are too often made of wood, which is generally an unsuitable material, and should only be used when nothing better is to be obtained. Old planks and parts of packing-cases or boxes are to be condemned, though railway-sleepers (if in good condition and well bedded) are very serviceable, especially if an additional coating of tar is given to preserve them. Bricks, however, make the best kind of wall, and should be employed where possible, if only for the lower part of the building. A wooden fence may be well built on the top of two or three suitably laid rows of bricks. The jointure of the wall and the floor should be carefully attended to as, if moisture gets in, the floor may be broken and the whole work wasted. It is advisable, therefore, to add a little cement-sill at the bottom of the wall to fill up the angle, and make the water run away into the channels. If bricks cannot be obtained—and there are many places where bricks are scarce—stone flags may be set upright and made into a sort of paling. This is done in many parts of Lancashire. But if neither brick nor stone is available, and it is considered too expensive to build a concrete wall, wood must be used. In that case a sheet of zinc or iron should be screwed on the wooden walls inside the pig-sty to preserve them from damp and from destruction by the pigs. Walls should be firmly built, and care should be taken not to build them so high as to shut out the light and air from the swine; a few gaps may be left outside provided that they are small enough to prevent the entrance of rats. The gaps should not be so numerous as to prevent the walls being a protection against the wind and the cold.

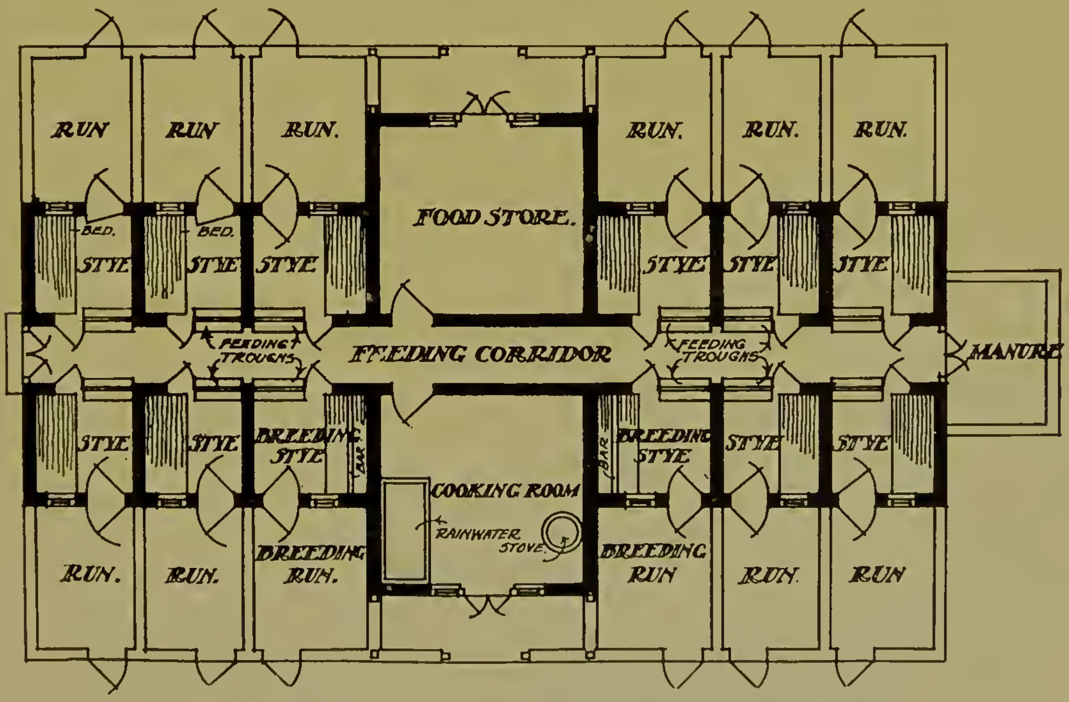
Essentials in Roof-building. "(3) The walls being built, it only remains to add the *roof*. This should be raised well above the floor of the inner court, leaving room for plenty of fresh air, without which the pig-sty becomes very foul and liable to spread disease. The roof should, in fact, be high enough in at least one place to enable a man to stand up when he is cleaning the floor. This can easily be arranged in the kind of shed known as the 'lean-to,' which is the most popular form. The material of which the roof is made is of no great importance provided that it keeps out the wet and the cold. Tiles, slates, or thatch may be used, and in many parts of Yorkshire tarred brattice-cloth is commonly



Perspective View of New Piggery designed and erected at Mandal, Norway, for Lord Salvesen *

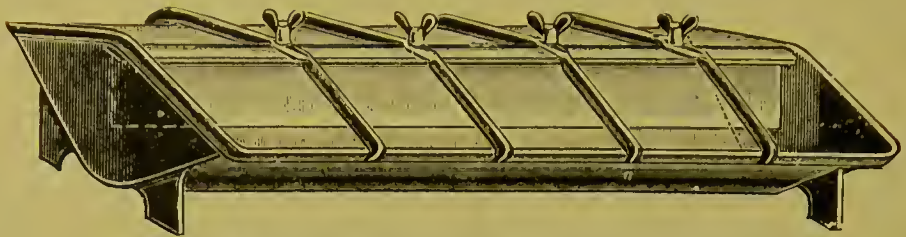
employed. Iron, however, should not be used, at any rate alone, as it lets in the heat in summer and the cold in winter. A window is strongly recommended for the purpose of letting in light, and a pane of glass should certainly be let into the wall or the roof if a proper window cannot be built. It cannot be too often repeated that light, warmth, dryness, and cleanliness are necessary for the profitable keeping of pigs.

" In the description that has been given it has been assumed that the inner court stands four square behind the outer court from the point of view of a person looking over the wall at the bottom of the sty. The entrance from the outer to the inner court should be on the left-hand side from the same standpoint, and the pig's bed, therefore, will be on the right-hand side, or the innermost part of the whole sty. A healthy pig seldom leaves any droppings or water in its bed, but in case any liquid should get there, it is as well to make a small drain running straight from the place where the bed is put to the outer court, and so on to the bottom of the sty. The bed should be a very low platform of wood, raised just high enough to allow free ventilation, and should be covered with plenty of straw, bracken, or other litter, which should be kept fresh. If the



The Ground Plan of the Piggery shown above

* From the plans of Mr. R. S. Wyld, Architect, London.



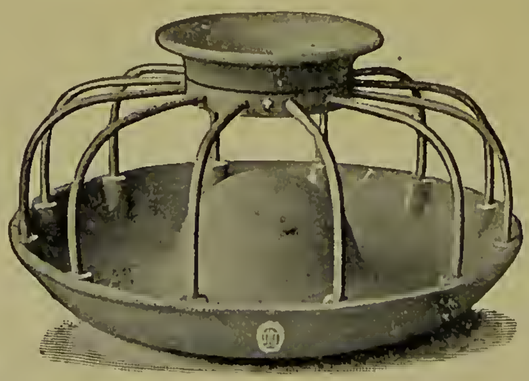
Glazed Feeding-trough with Strong Cross-bars

sow is about to litter a piece of piping should be fixed a few inches from the wall to prevent her overlaying her young. The inner court may now be considered complete.

The Question of Drainage. " In the outer court the drainages should run down to the right-hand side, as already said, and that for two reasons. In the first place, the pig's trough should be at the bottom of the sty, on the left hand, in order that the pig may come straight out of the inner court to the food. This trough should be made of earthenware or iron, and should be firmly fastened to the ground. Just over this trough should be a hole in the wall, with a falling door made of iron, so fitted that the pig's food can be poured straight into the trough without entering the sty. If this is thought too expensive, an earthenware pipe might be fixed in the wall, slanting at such an angle that all food poured in at one end must run into the trough. Care should be taken to keep the trough and the pipe clean and sweet. On the right-hand side, at the bottom, should be the gate leading into the outer court, and the drain should run straight down from the pig's bed to this gate, and this is another reason why the drainage should run to the right. But when collected there, it should not be allowed to lie but should be led away by an open drain to a sump at some distance, far enough off at least to keep the sty fresh and clean.

" The outer door must be strong ; it would be a foolish waste to build good walls and then hang a rickety gate on them. It is only necessary to say that if it be of wood a plate of iron or zinc should be screwed on to the inside to prevent its destruction by the pig. Some people advise a door between the inner and the outer court, but though advantageous this is not necessary. If it is added, it should be made in two parts, an upper which can be bolted at pleasure, and a lower which swings freely without quite touching the ground.

" The above description applies to the building of a single sty, but more sties may be erected on the same model, side by side with each other, without any alteration. Each sty should have a separate drain as described above, and it is false economy to make one drain pass through all the sties, as is sometimes arranged. It is really dearer, for



Round Feeding-trough

the sty through which the drain passes last is usually wet and unhealthy, and if disease breaks out in the top sty, all the swine are likely to be affected. An excellent method is to put the sties back to back, with a small gangway between, down which a man can walk, and from which he can see if the swine are faring well or climb over the wall to clean out their beds. This plan has also the advantage that it gives more air to the inner courts of the sties. It is perhaps as well to add that if a number of pigs are kept in one sty the trough should be so arranged as to prevent the animals crowding one another.

"If a really large number of swine are kept, it is very desirable that the piggeries should not be all together. It is advisable to have several sties in different parts of the farm, with separate sheds for the boars, the in-pig or farrowing-sows, the stores and the fat pigs. There should also be an isolation shed into which a pig can be put if noticed to be amiss or off feed for more than a single meal. It is a serious matter to get swine-fever into a valuable herd, and precautions should be taken at once to isolate the infected animal, as well as to notify the fact in the way provided by the law (Swine-Fever Order, 1894)." *

From day to day there are operations which have to be observed in connection with swine husbandry, and which have been succinctly put into calendar form by Mr. W. J. Malden,† and as his calendar is quite complete in its way we give it here:

The Months. *January.* This is recognised as the coldest month, consequently warm housing of pigs is of great importance. At the approach of severe frosts special attention should be given to secure the warmth of the sty and dryness of the floor. Damp litter should be removed regularly and a dry bed always be available. Little pigs thrive badly if allowed to run out in the cold yards. Only strong stores and breeding-sows should be allowed out of the sties The earliest, and generally most profitable, litters are due in this month. It is highly important that the little pigs are not allowed to stray from their mothers, as they rapidly catch chills. When the little pigs begin to feed, their food should be given them in a tepid condition. All pigs are better for a few roots. As no other green food is available, swedes, carrots, kohl-rabi, and cabbages are the most suitable now. It is a good season for killing, as meat keeps well in cold weather. Fast the pigs at least twelve hours before killing. Evening is a good time for killing, as the meat sets before morning, so that it can be cut up and dealt with then. Slaughtering in the evening is of most importance in warm weather, because it permits the meat to be dealt with sooner.

February. The trade for store pigs begins to be more active, and it is a good season for selling young ones; as the pigs do well from this season onwards, it is also a good season for buying.

March. Breeding and buying young pigs should continue. January pigs will require weaning and castration. Promising young sow pigs should be selected to run as breeding yelts. Sows on weaning should be closely watched so that they may be sent to the boar at the proper time. Cold March winds are prejudicial to young pigs, but if they can run out in the sun for a short time in a yard or court protected from wind they will benefit by it.

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* From leaflet issued by Department of Agriculture for Ireland.

† "Rational Pig-keeping to ensure Profit." By W. J. Malden. 1906.

May. Summer pig-keeping may be said to commence this month. There is a plentiful range of crops which are suitable for feeding and grass becomes long, affording good grazing. The heavy pork season ends when May comes in, and a small size is more marketable.

June. Store pigs and breeding-sows find little in the yards at this season, and require proper feeding. Feeding meals are generally dear at this season, so it is not advisable to have many fattening pigs in the sties. Store pigs thrive well on the ample supply of green food and dairy waste, and cost little to keep.

July. Pig-keeping at this season differs little from the preceding month. Second-early cabbages and spring-sown vetches should be plentiful. Pigs should be able to find shade in hot weather, and they require to have water or wash by them. If they can roll in a muddy pool they will be more comfortable, as this is practically the only means they have of defending themselves from flies and other insects, which cause them pain and inconvenience.

August. August is identified with harvest, and a fresh supply of food becomes available. Green fodder should, however, be freely used, particularly as such crops as tares, when maturing, are very rich in feeding-matter. Store pigs may be run on the stubbles as soon as the corn is harvested.

September. The winter season for pork commences with this month, and pigs which were born in the early part of the year find a trade. There is food for the stores on the stubbles. Potato-digging is general and a supply of food is generally available, as there are always diseased and injured potatoes to be disposed of. Drumhead cabbages are now fit for feeding, and provide food until Christmas. Nights get colder, and small pigs should be properly housed at night.

October. All young pigs should be kept warm, as the autumn rains and cold weather quickly produce chills. Older pigs may range on the stubbles and after acorns, but should be supplied with extra food, and only allowed to be out for a short time. By the end of the month it is advisable to have all pigs in the yard. Winter sometimes sets in in October, and it is well to consider it a winter month, as by preparing for it loss is prevented. Mangels and potatoes should be got up before the end of the first week of November. Young sows should go to the boar.

November and December. November is a good month to put the young sows or yelts to the boar. Those born in the early months of the year should go to the boar when they are eight or nine months old. Little pigs require very warm housing. It is better to buy strong stores than those directly from the sows at this season. Turnips, carrots, and cabbages are the best green food at this season. Potatoes (if cooked) are very valuable and should never be wasted; they, however, must not be depended upon as a diet. These two are among the most difficult months for the pig-keeper, because of the cold, damp weather, and he cannot attend too closely to the warmth and comfort of the sties.

Begin the year, and continue to the end of the year, with the motto that cleanliness and warmth with regard to the sties form the first principle towards successful pig-keeping. And never forget that the pig will turn to profitable account much that would otherwise be lost, and you will then find the truth of the old adage, "Waste not, want not."

The Output of Bacon-pigs. The final test in connection with bacon-pigs is the weight in relation to the bacon produced, and this is obtainable only at the bacon factory.

In the north of Ireland a curious custom prevails of selling, at the markets, the carcases of pigs which have been slaughtered on the farms, and as a consequence bacon- and ham-curing in the north of Ireland is carried on in a different way from other parts of the country. Pigs are not slaughtered in the bacon factories at all; the carcases, without the primary offal, are purchased. There is, therefore, no kind of provision made in these north of Ireland factories for slaughtering.

In many of them, accurate accounts are kept of the output realised from the carcases handled, and the following statement shows an actual balance-sheet, which was arrived at in one of these factories in 1908:

Results obtained from an intake of 248 pigs, in the month of June 1908. Two hundred and forty-eight pigs weighed 395 cwt., or an average of 1 cwt. 2 qr. 11½ lb. per pig.

Percentages taken at the Block

	cwt.	qr.	lb.				
Fresh bacon, 496 sides . .	196	3	3	or	49.82	per cent.	of pig.
Fresh hams, 496 hams . .	84	3	15	,,	21.49	,,	,,
Fresh meats amounted to					27.69	,,	,,
Allowed for loss in cutting					1.00	,,	,,
Total					100.00	,,	,,

Results obtained from an intake of 437 pigs in the month of November 1908. Four hundred and thirty-seven pigs weighed 688 cwt. 19 lb., or an average of 1 cwt. 2 qr. 8½ lb. per pig.

Percentages taken at the Block

	cwt.	qr.	lb.				
Fresh bacon, 874 sides . .	344	0	0	or	50.00	per cent.	of pig.
Fresh hams, 874 hams . .	148	3	23	,,	21.61	,,	,,
Fresh meats amounted to					27.39	,,	,,
Allowed for loss in cutting					1.00	,,	,,
Total					100.00	,,	,,

The proprietors of the factory referred to, in calling attention to this balance-sheet, state that they are unable to give the percentage of the pig to the primary offal, owing to the fact that they do not kill pigs themselves, but purchase them in the shape of carcases in the pig-carcase markets of Ulster. They also point out that it is noticeable in connection with the balance-sheets which are given for the fresh meats or secondary offal, amounting to 27.69 per cent. of the pig, that all the intakes they have analysed have given them practically the same result as those shown on these balance-sheets with regard to the percentages of bacon, hams, and fresh meats. They have each week, for some years, checked figures of a like character, and they have found almost the same average weight per pig, although they have taken their figures at different seasons of the year.

In connection with this branch of the subject, it may be reckoned * that the two sides of a pig will weigh four-fifths of the actual live weight. If a pig weighs 200 lb., then two sides fit for curing in the Wiltshire style would weigh 160 lb. (80 lb. each). These sides would lose 2½ lb. each in salting, and, if smoked, another 1½ lb. each, or a total of 8 lb. in all.

The same authority gives a number of tables which accurately illustrate the turn-out from various classes of pigs :

ACTUAL WEIGHINGS OF FOUR PIGS OF DIFFERENT WEIGHTS SHOWING THE WEIGHT OF OFFAL OF VARIOUS KINDS

	No. 1 Pig. Sides marked 1 and 2.	No. 2 Pig. Sides marked 3 and 4.	No. 3 Pig. Sides marked 5 and 6.	No. 4 Pig. Sides marked 7 and 8.
Payable Weights.	11 sc. 19¾ lb. =239¾ lb.	9 sc. 15 lb. =195 lb.	7 sc. 13 lb. =153 lb.	7 sc. 6 lb. =146 lb.
Bones . . .	6¼ lb.	5¾ lb.	4¾ lb.	4 lb.
Blade-bones . .	2¼ ,,	2¼ ,,	1¾ ,,	1¾ ,,
Steaks . . .	2¼ ,,	2¼ ,,	1½ ,,	1½ ,,
Cuttings . . .	2 ,,	2 ,,	1½ ,,	1½ ,,
Kidneys . . .	½ ,,	6 oz.	½ ,,	½ ,,
Flick-lards . .	8¾ ,,	7 lb.	5½ ,,	4¼ ,,
Fat . . .	2½ ,,	2¼ ,,	1½ ,,	2 ,,
Feet . . .	3¾ ,,	4 ,,	3 ,,	2½ ,,
Blade-bones . .	½ ,,	½ ,,	½ ,,	½ ,,
Skulls . . .				
Chaps and tongues .	7¾ ,,	14½ ,,	9¾ ,,	8¾ ,,
Tongues . . .	11¼ ,,	2½ ,,	1½ ,,	1 ,,

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* Douglas's "Encyclopædia for Bacon, Meat, Provision and Food Industries." By Wm. Douglas and Sons, Ltd., Putney, London, S.W.

ACTUAL OUTPUT OF BACON FROM FOUR PIGS OF DIFFERENT WEIGHTS

Two Sides.	cwt. qr. lb. 1 2 24		cwt. qr. lb. 1 1 12		cwt. qr. lb. 10 0 9		cwt. qr. lb. 10 0 6	
	Sides.		Sides.		Sides.		Sides.	
	No. 1	No. 2	No. 3	No. 4	No. 5	No. 6	No. 7	No. 8
	qr. lb.	qr. lb.	qr. lb.	qr. lb.	qr. lb.	qr. lb.	qr. lb.	qr. lb.
Same day as killed . .	3 11	3 13	2 20	2 20	2 6	2 3	2 4	2 2
Day after killing . . .	3 10	3 12	2 20	2 20	2 5	2 3	2 4	2 2
Weight of sides when cured (21 days old)	3 8	3 11	2 19	2 19	2 3	2 1	2 3	2 1
Weight of sides washed and drained	3 8	3 10	2 19	2 18	2 3	2 0	2 2	2 1
Weight of sides when smoked (28 days old) . . .	3 3	3 5	2 14	2 13	1 27	1 24	1 26	1 25

ACTUAL WEIGHINGS OF A PIG 7 SCORE 13 LB.; EQUAL TO 153 LB. PAYABLE

Bones . .	4¾ lb.	Two sides—121 lb.
Backbone .	1¾ ,,	
Steaks . .	1½ ,,	Day after killing—going into salt, 120 lb.
Cuttings . .	1½ ,,	
Kidneys . .	½ ,,	
Flick-lards .	5½ ,,	Cured (twenty-one days old)—115 lb.
Fat . .	1½ ,,	
Feet . .	3 ,,	
Blade-bones .	½ ,,	Smoked (twenty-eight days old)—108 lb.
Head . .	9¾ ,,	
Tongues . .	1½ ,,	

ACTUAL WEIGHINGS OF A SOW 16 SCORE 8 LB.; PAYABLE 328 LB.

Flick, kidneys and skirt	16 lb.
Head	26 ,,
Backbones	4½ ,,
Ribs	11½ ,,
Spare-ribs and bones	2½ ..
Griskin	6½ ,.
Four knuckle-bones	8[illegible] ,,
Four feet	7½ ,,
Rinds	12½ ,,
Fat for melting	23 ,,
Meat for sausages	210 ,,

ACTUAL WEIGHINGS OF TWO SIDES OF BACON SMOKED

	No. 1 Side. Weighed 2 qr. 16½ lb.		No. 2 Side. Weighed 2 qr. 5 lb.	
	qr.	lb.	qr.	lb.
Three-quarter side . .	1	26½	1	16½
Fore		18		16½
	2	16½	2	5
Jacket	2	0½	1	19½
Gammon		16		13½
	2	16½	2	5
Fore		18		16½
Middle	1	10½	1	3
Gammon		16		13½
	2	16½	2	5

THE ACTUAL OUTPUT OF BACON FROM VARIOUS SIZES OF PIGS, AND THE WEIGHTS OF BALES AND VARIOUS SELECTIONS

		Dead.	
	cwt.	qr.	lb.
Whole pigs, heads, feet, and offals, weighing .	1	0	0
Give sides of about 46 to 50 lb. culled six-sided bacon.			
Whole pigs, heads, feet, and offals, weighing .	1	1	0
	to 1	1	14
Give sides of about 54 to 58 lb. culled sizable, top price.			
Whole pigs, heads, feet, and offals, weighing .	1	0	15
	to 1	2	0
Give sides of about 60 to 64 lb. culled stout, sizable.			
Whole pigs, heads, feet, and offals, weighing .	1	2	1
	to 1	3	0
Give sides of about 65 to 75 lb. culled, heavy.			

These are the general weights bought, but they are again selected according to degree of fatness, quality, &c., and give the following selections :

Six-sided bacon, six sides to a bale; selected fat and lean six-sided bacon.

Sizable bacon, 54 to 56 lb. sides, selected as follows:

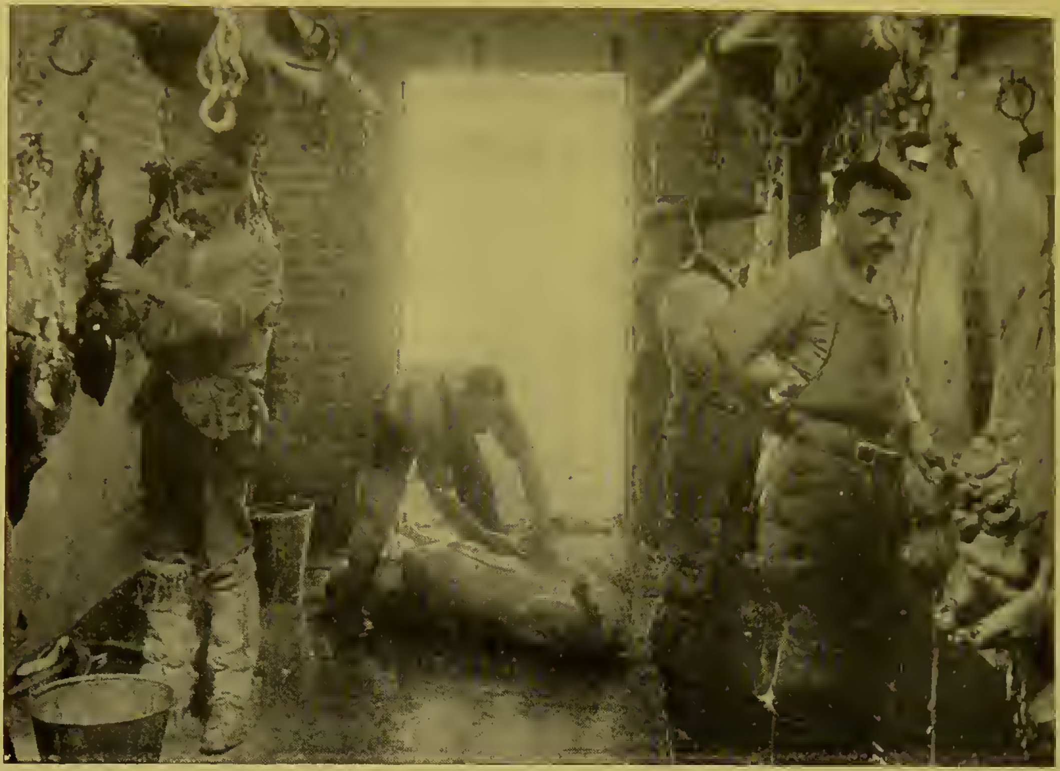
Nos. 1, 2, 3, sizable and stout sizable 58- to 62-lb. sides selected into fats and mediums, and lean medium; next are heavy lean, heavy and extra heavy; next are ½ branded goods—seconds.

Prices vary with the market. Sizable lean is generally top price, but other selections often come near it if the supply is short.

Buying Pigs. Pigs are generally bought by the live weight or by hand The system of buying by live weight is rapidly on the increase, and has come greatly into favour because of its obvious fairness both to buyer and seller. Buying by hand is a somewhat risky business and involves considerable knowledge on the part of buyer and seller, which is modified by the live-weight scale. In bacon factories pigs are bought by the dead weight, that is to say, the primary offal consisting of the principal contents of the thorax and the abdominal cavity are removed, and the carcase is then weighed with all the secondary offal attached, which also includes the leaf-lard and kidney.

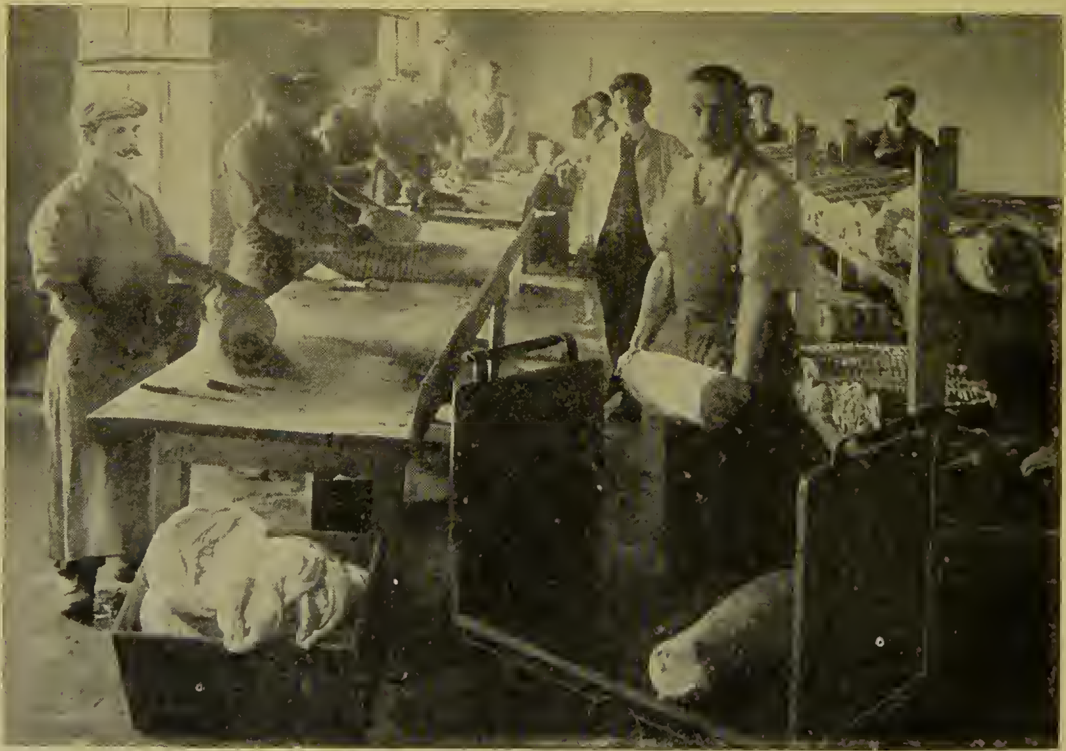
The system of buying pigs by thickness of fat has been adopted in the west of England by some of the bacon-curing houses there. It has been in operation for some years, and is recognised by the farmers as fair and equitable. The following table shows the method of adjusting the prices:

Weight of pigs.		Thickness of fat in any part of the back.	Price.
1	6 sc. 10 lb. to 9 sc. 10 lb.	Not exceeding 2¼ in.	Top price.
2	Under 10 sc. 10 lb.	Not exceeding 2½ in.	6*d.* per sc. less than 1st price.
3	Under 11 sc. 10 lb.	Not exceeding 2¾ in.	9*d.* per sc. less than 2nd price.
4	Under 12 sc.	Not exceeding 3 in.	9*d.* per sc. less than 3rd price.
Pigs exceeding these limits, and soft, or otherwise inferior, are paid for at their value.			



A SLAUGHTERING-PEN IN DUMFRIESSHIRE AT THE PRESENT DAY

The method used in this particular slaughter-house is common in the west of Scotland; the pigs are not hoisted as in some places.



ROLLING BACON IN A DUMFRIESSHIRE FACTORY

CHAPTER VII

BACON- AND HAM-CURING

THE art of bacon-curing dates back to very early times, but the primitive methods of early days have long since passed away. Salting of meat was in early times an absolute necessity, as there was great scarcity of fresh meat during the winter. Beef was almost unknown amongst the poor people, and the flesh of the pig was the only meat which they ever tasted, and even that was not very plentiful.

It was the custom amongst farmers to salt their own flitches of bacon, and down to the present day that custom has obtained. So far back as the beginning of the eighteenth century (1705), Edward Lisle, the author of "Observations on Husbandry," states that bacon-curing was prevalent in Wiltshire at that date, but it did not exist as an organised industry until much later, and from that point of view the earliest account we have of bacon-curing in an organised condition is given by Robert Henderson.*

An Early System of Curing. "I practised," he says, "for many years the custom of carting my flitches and hams through the country, to farm-houses, and used to hang them in their chimneys and other parts of the house to dry, some seasons to the amount of five hundred carcases. This plan I soon found was attended with a number of inconveniences, as I had to take along with the bacon, pieces of timber, to fix up in the different houses, for the purpose of hanging the flitches and hams. For several days after they were hung up, they poured down salt and brine upon the women's caps, and now and then a ham would fall down and break a spinning-wheel or knock down some of the children, which obliged me to purchase a few ribbons, tobacco, &c., to make up peace. But there was a still greater disadvantage attending this mode: the bacon was obliged to hang until an order came for it to be sent off, which, being at the end of two or three months and often longer, the meat was over-dried in most places, and consequently lost a good deal of weight. This method is practised at this day (1814) in Dumfriesshire. People in general are so partial to old customs that it is nearly impossible to remove them."

Even then, it will be seen, the curing was done on the farm, but the drying and maturing were carried on elsewhere.

An early reference to bacon-curing is given in connection with the history of the town of New Ross, in County Wexford in Ireland, and it is stated that bacon-curing was carried on in that district two hundred years ago, and many "salters" were employed in curing the salt pork used by the British Navy.

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* "A Treatise on the Breeding of Swine and the Curing of Bacon." By Robert Henderson. 1814.

It was not, however, until about the middle of the nineteenth century that bacon-curing became an organised industry, and from that date until now progress has been rapid in many countries, notably in the United States, Canada, Denmark, and the United Kingdom. At the present day it is being recognised that bacon-curing forms one of the principal industries in connection with agriculture, and for that reason it has been taken up in various countries where pig-breeding is carried on.

THE HANGING-HOUSE IN A SCOTTISH BACON FACTORY

After the carcases are skinned and split in two, they are hung up in the hanging-house so as to allow the animal heat to dissipate.

Bacon-curing is carried on in three different ways: first, on the farm; secondly, in the meat- or pork-purveyor's shop; thirdly, in the factory or packing-house.

Bacon-curing on the Farm. The present writer has dealt at length with this subject,* and has stated that in the development of agriculture it is essential to keep in mind that the most profitable way to work the dairying department is by utilising the by-products. In the manufacture of butter the principal by-product is separated milk, and in cheese-making it is whey. Both of these commodities lend themselves to pig-feeding, and, indeed, provide about the very best food for the production of bacon. So far back as 1847 this fact was recognised by Youatt, who is, perhaps, the most trustworthy of authors on the pig. In his treatise entitled "The Pig," he states in the chapter on feeding, that "for sty-fed pigs the washings of the dairy, as butter- and skim-milk, whey, &c., are excellent, and especially whey thickened with barley- or oat- or pea-meal, whey being more nourishing than skim-milk; the animals thrive and make flesh so well on it that many farmers are of opinion that this mode of employing their sour milk is more profitable than making cheese. But when the swine have once become habituated to this kind of diet it must be continued, as they would fall off if put upon any other."

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* "Bacon-curing on the Farm," *Agricultural Journal of the Cape of Good Hope*, September 1907. By Loudon M. Douglas.

Many things have happened since 1847, and new authorities on the pig have sprung into existence since then. None, however, have materially altered the views of Youatt. Modern authors, such as Harris, Coburn, Spencer, Craig, Bondeson, Day, and others, practically confirm this opinion. It has been left to Professor Day to summarise the teachings of all the others, and to put in concise form in his book entitled "Swine" all that is worth knowing on the subject.

Foods which may be used. It seems quite certain, then, that separated milk combined with barley is the ideal food for pigs, but a modification of this feed will no doubt suggest itself to many who are not in a position to use that cereal. Maize may be used along with separated milk or green food, and the excess of oil which is present, and which goes to make oily fat in the pig, is to some extent neutralised. But exclusive maize-feeding will not do. Some harder food, such as cereals, must form part of the feed, more especially when finishing off. A good plan is to graze the young pigs for five months, then sty-feed them on hard feed for two. In that way firm, good bacon will be produced.

Amongst the foods which may be used are: cooked potatoes, oatmeal and crushed oats, pollard-bran, ground wheat, rye-meal, and separated milk, but it must always be borne in mind that what is wanted is firm meat, and this can only be produced by feeding such a ration as will not give too much oily substance.

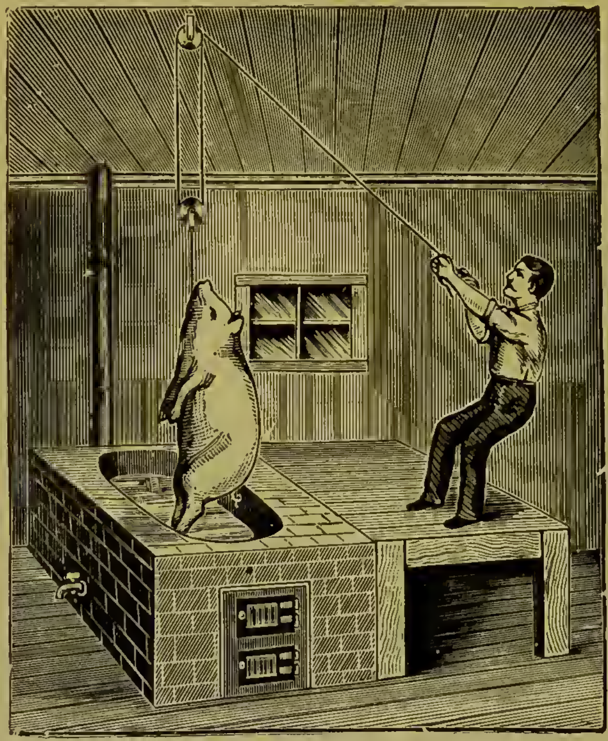
The great point in breeding pigs is the shape or conformation. A long, square, deep side is wanted, and it is just as cheap to feed pigs producing such sides as it is to feed short round ones that no one wants. Different breeds suit different districts and countries. The principal breeds cultivated in Europe are large Yorkshire and middle Yorkshires amongst the white pigs; the Tamworth, which is a red breed, and amongst the black breeds, the Berkshire, Suffolk, and Sussex. The Berkshire is a fine pig for crossing, and splendid results have been obtained by crossing large whites with Tamworths and then with Berkshires, but local circumstances must always determine what rule is best to follow.

It is well to know the general principles which govern the matter, and modify these to local needs.

When the pigs suitable to the district have been produced, it then remains to find out what will be the best use for them. They can be handled in two ways, viz.: (1) they can be made into bacon on the farm; or (2) they can be handled in a co-operative or other bacon factory.

The Necessary Equipment on the Farm. The equipment necessary for bacon-curing on the farm is small. The principal thing is to choose as cool a place for the curing process as possible, such as an outhouse or, better still, a cellar excavated out under any of the farm buildings; a small place will do. The floor should be laid with flagstones or cement, the atmosphere should be sweet, and the place should be dark but should be well ventilated.

The bacon-pig will weigh about 217 to 224 lb. live weight, and this pig will turn the scale at about 168 lb. dead weight; that is, with the offal, excepting the head, feet, and flake-lard, removed. It will be necessary, therefore, to provide a scalding-vat for a pig of this size. A large half-barrel or similar vessel will do. In addition to this, a simple rope pulley-block, a few wooden gambrels or spreaders, two or three 10.-in. straight knives, a steel, 20-in. back-saw, and a 10-in. Smithfield cleaver will complete the tools required. The pig may be first stunned by striking it sharply between the eyes with a mallet, and it is then slung by means of the pulley-block, which can be fastened to the branch of a tree or a cross-beam by one of the hind feet, head downwards, and a sharp 10-in. straight knife is inserted in the throat in the direction of the heart, so as to sever the main blood-vessels. The blood at once rushes out, and may be caught for use in making blood-puddings or allowed to go to waste. In a few minutes the carcase will be quite free from blood, and may then be lowered into the large tub already spoken of. This tub should be previously filled about half-full with water at about 160° Fahr., or just so hot that the hand cannot be held in it comfortably. The carcase is turned round about in this water until the hair comes away easily in the hand. The two hind legs are slit, so as to expose the sinews, and these are loosened with the finger. A gambrel or spreader is then pushed in beneath them, and the carcase is hoisted again into the vertical position head downwards. It is scraped all over quite clean by means of a blunt knife, or, better still, a pig-scraper, cold water being thrown over it occasionally meanwhile, so as to cool it down as much as possible. A slight incision with a knife is then made between the aitch-bones, and this is continued right down



Scalding the Carcase

A convenient arrangement for scalding pigs on the farm or in the small way is shown in this illustration.

to the apex of the lower jaw. Next, the knife is inserted so as to sever the aitch-bones, and the bladder and organs of gestation are removed. The crown end is then cut round and removed, along with the fat gut which has been loosened, right along the back. Then the remaining guts, stomach, and fat are all pulled out. The liver and kidneys are taken out, and are at once thrown into cold water so as to cleanse them. The breast-bone is severed by means of a saw and the skirt is cut right round as close to the flake-lard as possible, and the heart and skirt are cut from the lungs and thrown into cold water to be cleansed. The lungs and windpipe are removed through the severed breast-bone and cut off at the base of the tongue, which is left in the head, or may be cut out there and then so as to be used. All these various parts have their uses on the large scale, and they can also be utilised to much advantage on the farm. The guts, or intestines, should be cleansed thoroughly, then salted, and they can be used for sausage-making. The liver, tongue, kidney, heart, &c., can be used fresh. The stomachs, if well washed and cleansed, make a very palatable dish.

Directions in cutting up. The flake-lard remains still in the carcase, and must be removed so that when that is done the whole inside can be washed with cold fresh water. The flake-lard after cooling should be cut up and rendered.

It is necessary now to split the carcase in two, and this is done by making a straight continuous cut just under the skin, right down the back from the root of the tail to the neck. The next cut is made deeper on the right side of the backbone, making that side clear and without leaving much meat on the bone. The left side of the backbone is cleared in the same way, so that the two sides are now separate.

In factories, where the "dead weight" is taken, the head, feet, flake-lard, and backbone are all weighed in, but the remainder of the offal is not. If the pigs are weighed warm a deduction of 3 per cent. is made for "beamage."

On the farm, however, these matters are of no interest, as it is assumed that the farmer proposes to utilise most, or all, of the carcase in his own household.

When the head, feet, backbone, and flake-lard have been removed, the sides are allowed to hang until quite cool. A cool, shady spot is best for this purpose, and, if possible, the carcase should be hung where there is a gentle current of air.

The Curing Process. The next process is the curing of the meat. This cannot be carried out successfully unless the sides are cool and stiff. When this stage is reached they are taken down, laid on a table or a bench and trimmed. The inside is scraped free from fat, and the neck is trimmed free from bloody pieces, the steaks are taken out and are utilised forthwith in the fresh state. The neck-bones and aitch-bones are cut loose, and the spare-rib and breast-bones are taken away along with these. The tops of the ribs are also sawn off and the blade-bone taken out. The large blood-vein in the neck is removed, and the sides will then be trimmed complete.

It is now necessary to have ready some additional apparatus. A small pickle-pump is necessary, together with a supply of pickle and a salinometer to test the same. The pickle may be prepared the day before, so that it will be nice and cool. It is made from the following recipe:

14 lb. salt.
1¼ ,, saltpetre.
1¼ ,, dry antiseptic (Boron preservative).
1½ ,, cane sugar.

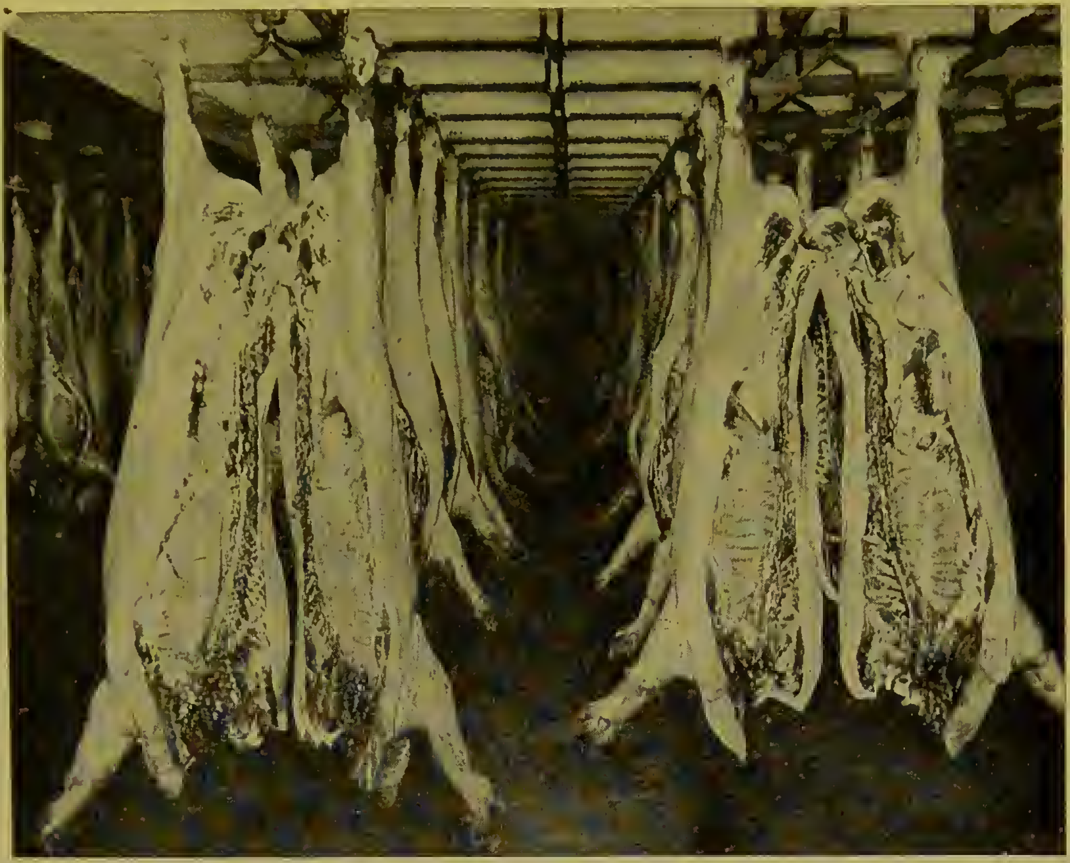
Make this up to five gallons with water, boil and skim till clear. The liquor should test 100° or thereby on the salinometer, and if it does not, it should be made up to this strength with salt.

By the aid of the pump this pickle is now injected into all the fleshy parts of the meat, and the sides are then laid on a bed of salt on the floor of the curing-place. The bed of salt should be about an inch thick, and a wooden stave should be used to press up the belly part of the side, which should be uppermost.

Now sprinkle all over the side an equal mixture of dry antiseptic and saltpetre, just sufficient to whiten it, and on the top of this put a heavy layer of salt. In fourteen days thereafter the bacon will be "mild-cured," for it does not require to be touched again, unless it has to be cured with the intention of keeping some months. Then, at the end of fourteen days, it will be necessary to add another dressing as before and keep for another fourteen days. The resulting bacon will be salty, but it will keep a good many months quite fresh.

How Smoking is carried on. When the bacon is cured, take it up from the curing-bed and wash it in some cold fresh water, then hang it up so as to drain for a few days. If it is wanted as pale-dried bacon, it can be hung in the kitchen after dusting a little dry antiseptic all over it, especially into the pocket-hole. It will be ready for consumption at any time, but will get a more pronounced flavour the longer it is kept. Should it be desired to smoke it, an old barrel may be requisitioned. It will require to be so deep that the side can hang freely in it. An old tin can, which has had a lot of holes punched in it, is then filled with hardwood sawdust, and after lighting it, the top of the can is covered with an iron plate so that as the smoke and heat come out they do not ascend right on to the bacon but curl round it. Three days may be taken to do the smoking, but that is a matter of taste. Of course a better smoke-house can be made by building a small place about 4 ft. square and 6 ft. high, with a few bars running over at the top, to which the bacon can be hung. Such a place should have a small ventilator on the roof; but that may be considered too expensive for the small quantity handled. Smoked bacon will keep longer than pale-dried because of the preservative qualities of the smoke.

In the curing of hams there is very little variation from the method of curing bacon. The ham is cut from the side and nicely trimmed. It is then thrown into a tub of the pickle already mentioned, and allowed to soak for two days. The blood-vein is then squeezed free from blood and the ham is laid shank downwards on the floor in a bank of salt. It is covered with the curing mixture similar to the bacon, and is kept twenty-one days in salt for mild cure and about fourteen days more if required for keeping a long time.



A Corner in an American Pork-cooler

Pigs are handled differently in America from the system in Europe. The above picture is from a photograph taken in an American pig-chilling room.

The wet cure for bacon and hams is very often practised. The meat, both bacon and hams, is simply thrown into a pickle as given and kept there until cured, the time being the same for either mild-cured or salt-cured meats, as before.

Besides bacon and hams there are many other products which may be conveniently made on the farm, such as sausages and blood-puddings. Then there is endless variety in dealing with the pig's feet, houghs, heads, tongues, &c. These should all be cured in pickle and cooked according to taste. It will be found, indeed, that with a little trouble much profit and satisfaction are possible by dealing with your own pig on the farm.

Bacon-curing in Shops. In the pork-purveyor's shop there is usually a large back room or cellar, and either of these may be usefully adapted to bacon-curing in the small way. It must be premised, however, that if the room or cellar is to be used, it should be kept fairly cool, and this can be attained either by the use of ice or by means of a small refrigerating machine. It is essential that the atmosphere should be fresh and cool, and the same directions as are given in connection with bacon-curing on the farm would then apply.

Bacon-curing in the Factory or Packing-house. The modern bacon factory has been so highly developed that its construction involves the application of a considerable knowledge of building and of engineering, but it would be rather difficult for any one to construct a bacon factory who is not conversant with the uses to which the various departments are put. A modern bacon factory may be constructed out of old buildings, which can be adapted to the various departments, but by far the best plan is to construct a factory from the ground upwards, and, in that case, the general design would be rectangular. This shape enables the various departments to conveniently fit the one into the other.

Generally speaking, the first essentials in connection with the construction of a bacon factory are : plenty of room, abundance of water and good drainage, and a description of a modern factory of the character already indicated will serve to illustrate these requirements. The factory selected is that at Roscrea, in County Tipperary, Ireland,* and the description and methods of formation have already been described by the present writer in the following words :

" The distinction of being the first farmers' co-operative bacon factory in the United Kingdom belongs to the town of Roscrea, in County Tipperary, Ireland."

History of the Factory. " The town has a history which goes back to the beginning of the seventh century, and at one time enjoyed much commercial prosperity, and it was also the seat of considerable ecclesiastical learning. At the present day the ' remains of its castles and ecclesiastical edifices, which were extensive and stately structures, with its ancient round tower, convey an idea of its former importance and render it an interesting object as seen from the hills in the neighbourhood, which abounds with picturesque scenery.' Roscrea is situated in a splendid position, and in the middle of a prosperous agricultural area, whence some of the best pigs in Ireland have been drawn. This fact impressed itself upon so many members of the Roscrea community some few years ago that steps were taken to test the feeling of the agriculturists as to the prospects of combining, so as to form a co-operative bacon factory in their midst. A work of this sort, however, is naturally somewhat difficult, inasmuch as no such undertaking had been realised in Ireland before, and as a consequence there was nothing in the way of local data which could be referred to by way of comparison, and the only authoritative information which could be thus utilised was such as could be obtained from Denmark, where co-operative bacon-curing has attained so signal a success that, although only commenced in the year 1888, there

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* " A Short Account of Roscrea Co-operative Bacon Factory." By Loudon M. Douglas, *Journal of Agriculture*, Western Australia.

Roscrea Bacon Factory: The Hanging-house

are now in that small country some thirty-three farmers' co-operative bacon factories.

"The district in which the supporters of the factory exist may be taken as the area within a radius of eighteen miles round about Roscrea, including parts of King's County, Queen's County, Kilkenny, and County Tipperary, and the work of organisation in such a large area—considering that the means of transport are difficult—was a very heavy one, and all credit, therefore, is due to Father Cunningham and those associated with him for the immense amount of hard work which they put in, in season and out of season, in order to bring about a successful organisation. In this they were ably seconded by Mr. William Scully, and the usual method was to hold a meeting in a schoolroom or in the open air at some village and put forward the advantages of bacon-curing, after which a local committee would be formed, and the members of this committee would then accompany Mr. Scully from house to house so as to invite the residents to take up shares in the factory. In this way twenty-six parishes were organised, and each parish formed a unit from which ultimately forty-six representatives were appointed so as to form a General Committee. Thus, at the end of about two years from its inception, this General Committee met in Roscrea and proceeded to formulate rules for the proper conduct of the business, in which they were assisted by Mr. R. A. Anderson of the I.A.O.S."

The Curing-cellar at the Roscrea Bacon Factory

Improving the Breed of Pigs. "One of the first steps was to see to the improvement of the breeds of the pigs in the neighbourhood, and in this work the Department of Agriculture and Technical Education for Ireland came to the assistance of the committee with a grant of £100, and this sum, small as it is, was judiciously expended in teaching farmers what kind of pigs are wanted for bacon-curing, and also in the supply of stud boars which were placed at the service of local breeders. It must be borne in mind, however, that County Tipperary and the adjacent counties have long been celebrated as one of the best pig-breeding districts in Ireland, and that the principal supplies from these areas have been sent to Limerick for many years. The characteristic of the bacon produced from these pigs is that it is firm in texture.

"Having formed a General Committee, it was necessary then to appoint a Directorate, which would be responsible to the committee, and this was done, twelve gentlemen from each district having been duly elected. It may be well to state that the directors retire in rotation but are eligible for re-election. The General Committee and the shareholders thus have a complete control over the administration of the business."

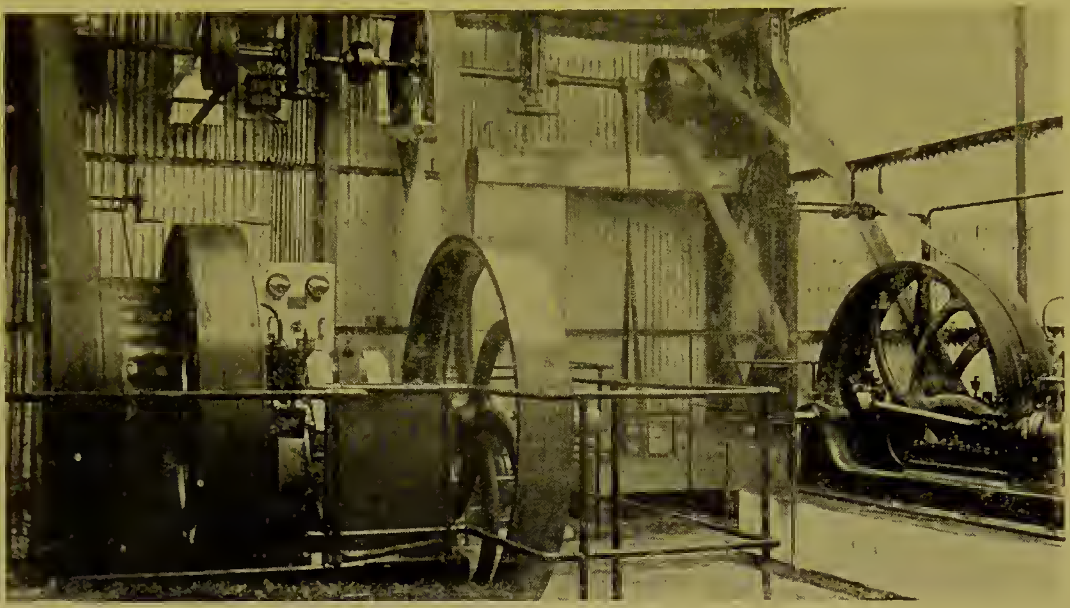
Rules for Supply. "The Roscrea Bacon Factory was inaugurated and has been carried on since its start as a Friendly Society, and is registered under the Friendly Societies Acts. It is purely co-operative in principle, and each shareholder is entitled to share in the profits according to the number of pigs he supplies. A statutory rule exists that each member of the society must, under a penalty of 10*s.* per pig, offer such bacon-pigs as he produces and *all* of them to the factory. This ensures a constant supply of the raw material, and also prevents any attempts by outsiders to unduly influence the local markets temporarily, so as to induce pig-breeders to send their pigs elsewhere. On the other hand, it is laid down that a bonus will be given to pig-suppliers according to the number of pigs which they produce. The rules are very comprehensive in character, and are subscribed to in a declaration which each shareholder has to sign and which forms a definite and binding contract."

Share Capital and Buildings. "The number of shareholders is about 3000, and the capital aimed at is £15,000. It was not thought necessary to call up the whole of this sum to begin with, but the enormous success of the undertaking has made it necessary to revise this decision, and in consequence the directors have decided to call up the whole of the capital so that the trading of the society may be conducted on the best possible lines.

"The building is situated on a plot of land adjacent to Roscrea railway station, and is constructed throughout of corrugated iron, which forms the roof and sides and which is carried on vertical iron columns. The total area covered is approximately 136 ft. × 120 ft., and the departments are laid out in the following order: (1) receiving-shed; (2) pigsties; (3) catching-pen; (4) sticking-pen; (5) bleeding-passage; (6) scalding-tank, scuttling-table, singeing-furnace, and disembowelling-bars; (7) hanging-house; (8) gut-house; (9) chill-room; (10) curing-cellar; (11) sausage-room; (12) lard-room; (13) packing-house; (14) smoke-stoves; (15) engine- and power-room; (16) offices. It will thus be seen that the factory embraces all the various departments necessary in a modern building of the kind.

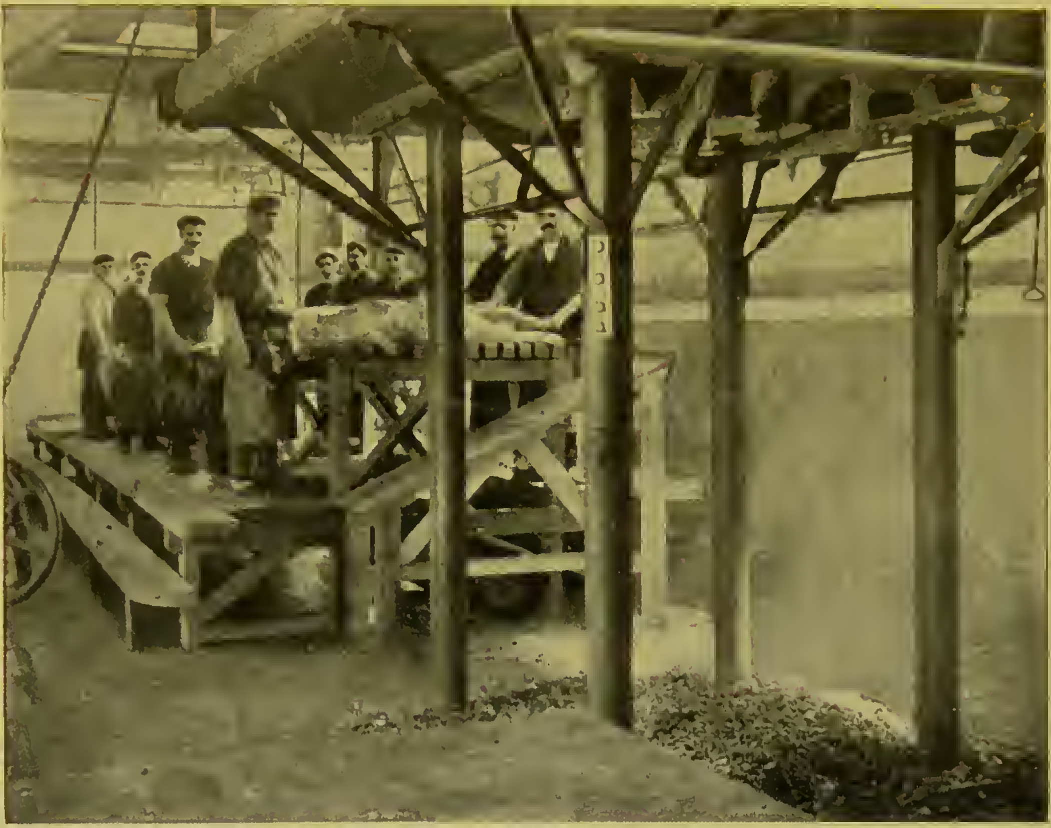
"The capacity of the bacon-factory is 750 pigs per week, and the total cost, including the land, was about £7500."

Working Methods. "The pigs are first of all received at the receiving-shed, and the factory is prepared to pay for them there and then by live weight. As a matter of fact, all pigs are passed over a live-weight scale, but the farmer has the option of being paid either by live weight or by dead weight. The difference that is reckoned between live weight and dead weight is put down at one-third, so that if the factory pays 30*s.* per cwt. live weight, this is equivalent to a difference of 10*s.* or 40*s.* dead weight. The receiving-shed is so constructed that farmers' carts can be brought up close, and the pigs are able to walk straight on to the receiving platform, and thus all accidents are avoided. After they are weighed alive the pigs are driven into the pig-sties, which are seventeen in number and have an accommodation for about two hundred pigs. Such a number of pigs may be received throughout the day, and they are allowed to rest until the following morning, when they are slaughtered. The slaughtering always takes place in the morning.

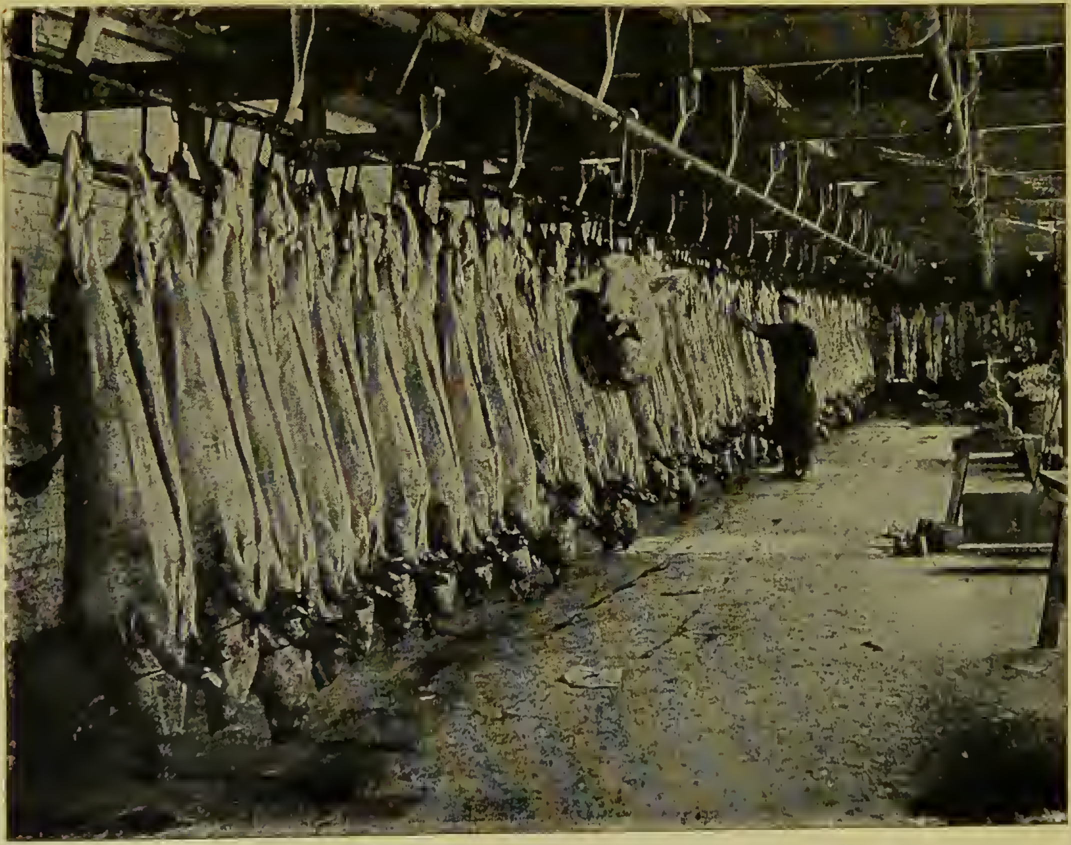


THE ENGINE-ROOM AT ROSCREA BACON FACTORY

"When the real work in the factory begins, the pigs are driven in batches into the hoisting-pen and are hoisted one by one. They are hoisted to an overhead track-bar in the sticking-pen by means of a hand-hoist and a shackling-chain, which is passed over one of the hind feet, and thus, when in a vertical position, the blood is let out, the whole operation occupying a very short time—the average being about one minute between the time when the pigs are driven into the hoisting-



View showing Scuttling table and Base of Singeing-furnace



Carcases on the Hanging-bars

The appearance of pigs on the hanging-bar previous to the scoring or cutting into sides is here shown.

pen and the time they are dead. As soon as the slaughtering has taken place, the carcases are pushed along into the bleeding-passage, which is broad and roomy and is capable of containing fifty or sixty pigs at one time. The walls of this department are lined with glazed white tiles, so that any specks of offensive matter which might be left behind are easily distinguishable and can be washed off. When the carcases are hung for some little time in the bleeding-passage, they are pushed along the hanging-bar, and are then thrown upon a dumping-table where the shackling-chains are removed. They are then rolled into the scalding-tank, where the hair is scalded off, and, as soon as this is accomplished, are thrown upon a scuttling-table where the hair is cleaned from the carcases. At this point it is necessary to determine whether the carcases have to be used for 'Wiltshire bacon' or as 'scalders from which the Irish bacon is prepared. If they are to be used for 'Wiltshire bacon' the carcases are passed through a singeing-furnace, which not only removes any hairs that may be left on, but hardens the skin and imparts the peculiar flavour to the meat such as is usual in 'Wiltshire bacon.' The carcases are then thrown into a cold-water bath and immediately hoisted to the disembowelling-bars, where they are disembowelled, dressed and cleansed by means of overhead sprays of water, the offal being carried to the adjacent gut-house.

"SCORING" THE CARCASES

The first operation after the carcases have been allowed to hang is the "scoring," which means taking out the backbone and severing the sides.

"Should the carcases not require to be singed, they are passed along an independent bar clear of the singer to the same disembowelling-bars, and are dressed in the same way. After disembowelling, the carcases are passed on to the dead-weight scale, where they are weighed and are then split down into sides and the backbones removed, and head and fore feet are severed and are allowed to hang by a small piece of skin. The flake-lard is removed and, together with the backbone, is thrown over the carcases, the sides being kept together by a small piece of unsevered skin at the nape of the neck. After dressing they are pushed on to the hanging-house, where they are hung for a number of hours so that the excess of animal heat may dissipate. When this has been accomplished, the sides are entirely severed and the various offal separated and handled in different departments. Thus the lard is taken to the lard-room; the head and feet are forthwith placed in pickle to be cured; the backbones are sent away fresh."

Curing Methods. "The dressing of a side of bacon is a process which requires some considerable experience, and it would take some time to describe. It will be sufficient, therefore, for our purpose here to say that the sides, after being properly trimmed and dressed, are hung in the chill-room, which is held at a temperature of 38° Fahr. and in which a constant current of cold dry air is circulating at that temperature. The meat is therefore reduced to about 38° Fahr., and this process occupies something like a whole day, after which the sides are passed into the curing-cellar. Here they are finally trimmed and the hind feet are removed, or, as the case may be, they are dismembered and converted into hams, middles, &c. In the case of 'Wiltshire' sides they are pumped with a recognised pickle (described later under 'Modern Bacon-curing') and are then sprinkled over with curing antiseptic, on the top of which is placed a heavy sprinkling of curing-salt. The same process takes place with almost every part of the pig, and on the average about two weeks are allowed for the curing, but of course this is modified according to the character of meat it is intended to produce. Hams, for example, are not pumped and are kept about twenty-one days in salt. When the meat is cured it is drained free of pickle, and is then removed from the cellar and washed. It is then, if wanted as smoked bacon, placed in the smoke-stoves, or if not wanted as smoked bacon or hams, is sent away in the green state.

"The various products of the Roscrea Bacon Factory are: Wiltshire sides, Dublin cut sides or 'middles,' hams, rolled fore-ends, rolled three-quarter sides and 'gams.' The products of the auxiliary departments are: sausages, black-puddings, lard, cooked hams, &c."

Other Features. "In all bacon factories the auxiliary departments call for very close attention, and we therefore find that the sausage-room and lard-room at Roscrea are completely equipped with machinery capable of producing sausages and lard in the most economical and best way. A notable feature of the factory, also, is the motive-power, which consists of a 50-horse-power gas-engine and suction gas-producing plant.

PRINCIPAL PARTS OF A SIDE OF PALE DRIED BACON, AND ALSO A PALE DRIED HAM

1. Gammon of Green or Pale Singed Side of Bacon

Cut close to, and showing ball of "femur" bone, full of quality and indicating warm tinge of singeing on skin, lean meat of silky texture and fine colour.

2. Middle of Green or Pale Singed Side

Good streaky small flank, lean meat—very rich in quality, back full of lean meat, back fat in good proportion—one-third thickness of lean meat, and of the finest substance.

3. Fore-end of Green or Pale Side

Cut close to the elbow-bone, showing two ribs, fine tapering towards neck, small collar, small hough, back fat—the desired thickness, lean meat perfect; an ideal fore-end.

4. Long-cut Ham, Pale Dried, of Small Bone

This ham carried great weight of fine quality, lean meat wonderfully intermixed with clear white fat; a ham which could be used to the last slice without waste.

We are indebted for the specimens of hams and bacon from which the coloured, drawings of these products are made, to Mr. J. W. Welsh, Manager of the Roscrea Co-operative Bacon Factory, County Tipperary, Ireland.—Authors.

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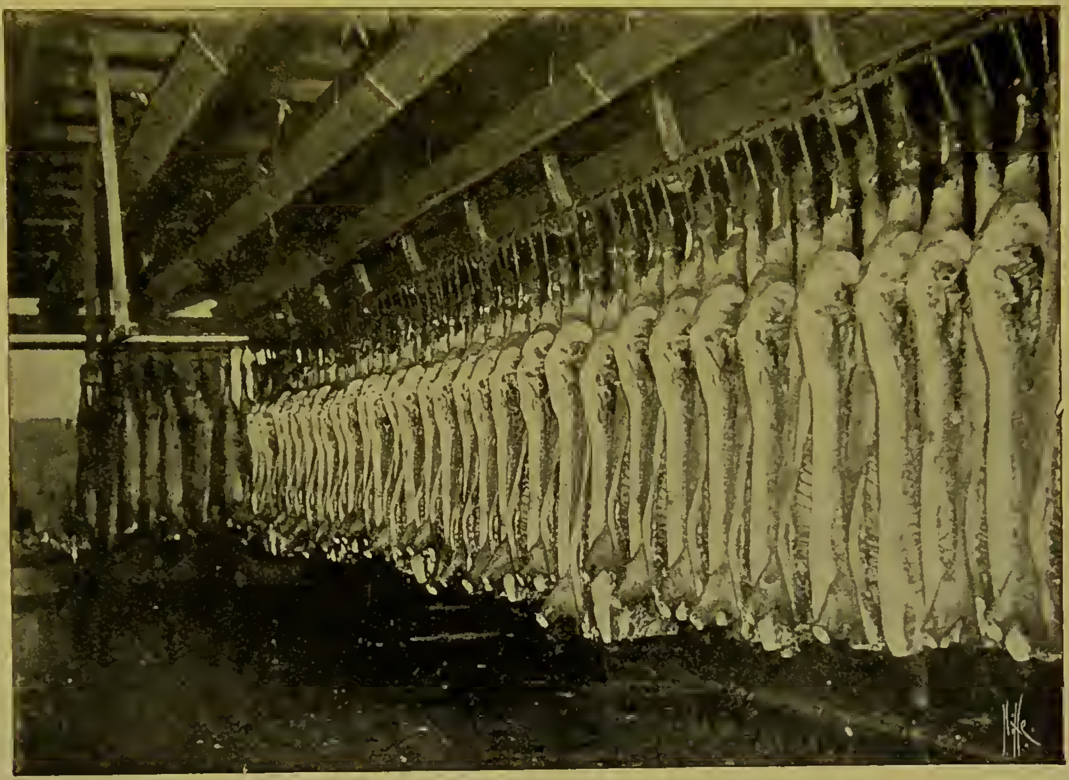
25 JUL 1929

This gas-engine is connected up to the main shaft and actuates the whole of the machinery throughout the factory. The principal machine is, of course, the refrigerator, which is called upon to maintain the chill-room at 38° Fahr. and the curing-cellar at 42° Fahr. The refrigerating-machine is a No. 7a 'Douglas' machine of the horizontal pattern, and the refrigerating gas used is sulphurous anhydride. It is connected to the chill-room by means of an independent air-cooler, which provides the circulation of cold air, and it is also connected with a complete system of brine-drums which cover the ceilings of both the chill-room and the cellar, through which cold, unfreezable brine is constantly flowing. It is necessary also in a bacon factory to have a plentiful supply of steam, and this is supplied by a vertical steam boiler which provides all the steam necessary for the scalding, cooking, cleansing, &c.



THE INTERIOR OF A MODERN CHILL-ROOM

This illustration shows a modern chill-room where the sides are chilled to 38° Fahr. before being placed in the curing-cellar.

"It only remains to be said that in such a factory there are, of course, offices suitable to the business, and there are also many necessary appliances of a minor character which are called into use in the various departments. The situation of the factory is such that no trouble arises from the surroundings and the drainage is perfect, so that all the conditions are hygienic and perfect in every way. The factory started on January 2, 1908, and has been working constantly, handling about two hundred pigs per week ever since. A feature of the business is that, whereas the factories which exist in Ireland at the present day rely upon the export

SIDES OF WILTSHIRE BACON IN A CURING-CELLAR
In the curing of Wiltshire bacon the sides are uniformly stacked as shown.

of their products, the Roscrea factory has so far not been called upon to look for markets outside of Ireland, and apparently will not be called upon to do so for a long time to come. The total staff employed is about thirty-two, so that the weekly expenditure in wages is not a very great item. At the same time, desirable employment is given to workmen in the vicinity.

"The launching of a farmers' co-operative bacon factory in Ireland is somewhat in the nature of an experiment, and the progress of Roscrea is being closely watched by many agricultural societies throughout the United Kingdom. This factory possesses many initial advantages, such as a guaranteed supply of pigs and a large body of shareholders, who in themselves form an important *clientèle* in so far as the products of the factory are concerned. It has also the advantage of having started with a comparatively small capital, and, indeed, it might be said that for such accommodation as is found at Roscrea no such place has been designed or constructed so cheaply before."

Where British Methods have been copied. The foregoing description of the Roscrea factory is given in detail, as the description of an actual factory conveys more to the mind than a disjointed description of various processes. It will be necessary now, however, to refer in detail to the subject of bacon-curing.

We find a great variety of appliances are used in different countries in connection with this industry. In the United States, the modern packing-houses include departments for bacon-curing and the handling of hogs, and also departments for the handling of cattle and other live-stock. They do not, therefore, compare with the factories in Europe at all, and the practice in the United States is also somewhat different. In Canada, on the other hand, the factories are exclusively devoted to bacon-curing, and the Department of Agriculture of the Dominion has made a careful study of the British methods of bacon-curing and have transplanted them to their own country. As a consequence, the price obtained for bacon from Canada compares favourably with what is produced in the United Kingdom. On the other hand, the products from the United States are sold at considerably lower prices. In Denmark, again, the processes of curing have been modelled on those developed in the United Kingdom, and we find, therefore, that the prices obtained are very close to those obtained for the British-cured article. British methods have also extended as far away as the British Colonies, South America, and the Argentine, the distinguishing feature being that, wherever British methods of bacon-curing are adopted the value of the manufactured product is increased.

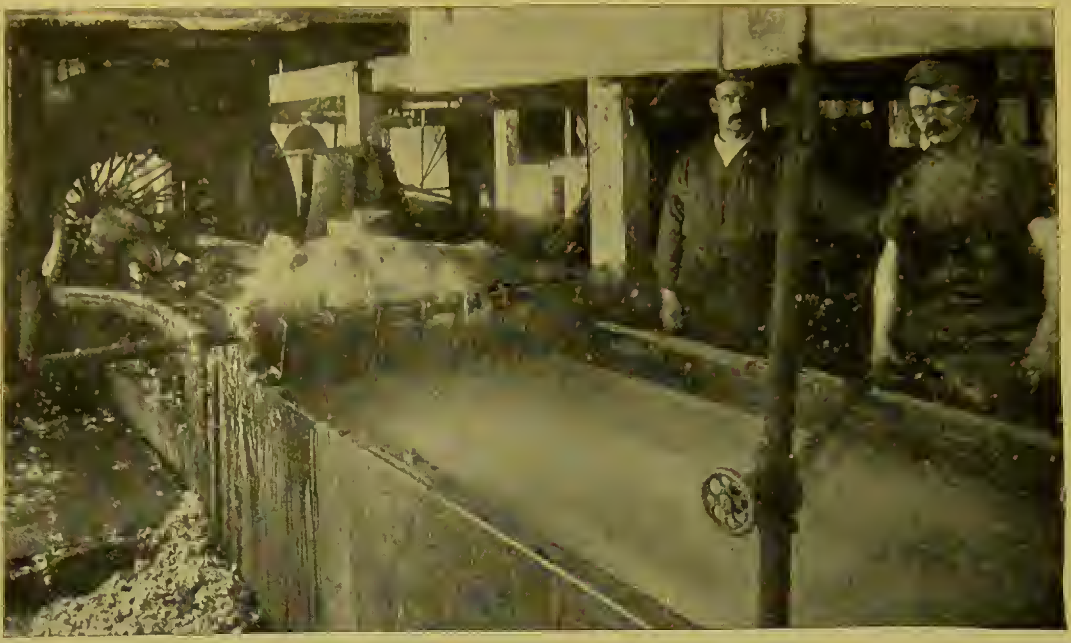
The processes in all countries are primarily what have been described in the Roscrea bacon factory. They may be modified to suit circumstances, but whether the quantity of hogs handled is small or large, the result is about the same.

MODERN BACON-CURING

The utilisation of the bacon-pig has given rise to a great many bacon factories, but these have sprung into existence within the last half-century. Previous to that time bacon-curing was carried on in a very primitive way, there being an almost total disregard of hygienic arrangements, and the intimate relation which exists between tempera-

THE SLAUGHTERING-PEN OF A BACON FACTORY

There are two ways of slaughtering pigs, one of which is to stun them and then let out the blood. The other way is to hoist them by one of the hind legs and let out the blood when in that position. Both methods are very speedy.



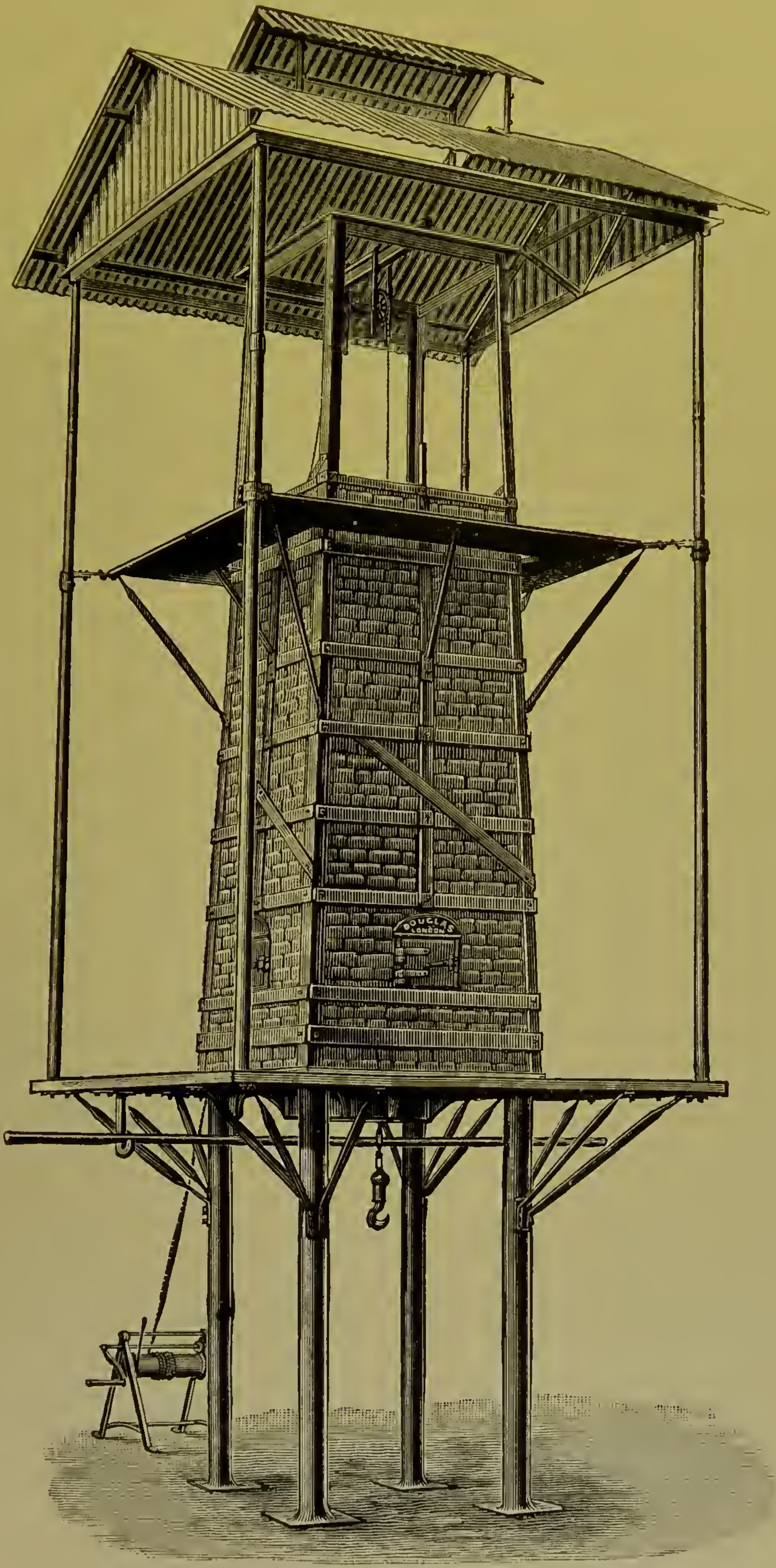
Scalding-tank and Scuttling-table

Where large numbers of pigs are handled it is desirable to use a mechanical pig-scraper, which performs the work, generally done by hand, of removing the hair from the carcase. The machine does it much more expeditiously and at very much less cost. In the illustration the pigs are being tilted from the scalding-tank on to the scuttling-table, whence they are carried through the pig-scraping machine.

ture and the curing of meat was very little understood. It was the custom to cure bacon in what were termed "cellars," and in most

Carcases on the Scuttling-table

In the preparation of some classes of pig-meats the carcases are not singed, hence they are simply scalded, tilted on to the scuttling-table, as shown, and scraped by hand. Bell-scrapers are generally used for the scraping process, one of which may be seen lying on a carcase.



Pig-singeing Stack

The carcases are first of all scraped so as to remove the bulk of the hair, and are then hoisted through the singeing-furnace by means of the hoist shown.

cases these were excavated out of the ground, apparently with the intention of securing as low a temperature as could be derived from the natural temperature of the crust of the earth. Subsequent to the time when these cellars were constructed, bacon factories sprang into existence, and it was found that low temperatures could be arrived at by means of ice, and, later, by refrigerating machinery. The curing processes, therefore have been better understood during the last century, and, while excavated curing-places are now almost unknown, the name "cellar" is still applied to the bacon-curing bed. In so far as the curing process is carried on at the present day, it will be best understood from a description of the actual operations which take place in a modern factory.

The System of Slaughtering. The pigs are first of all assembled in the pig-sties, and they are allowed to remain there so as to rest them and at the same time allow the stomach to be pretty nearly emptied of food. The operation of slaughtering in a large factory generally takes place in the morning, and the pigs are driven one by one into the catching-pen, where they are at once shackled by means of a leg-chain (which is passed over one of the hind feet) and are slung on to the overhead bar, which is suspended at a height of about eleven feet from the ground and which travels through the bleeding-passage. The pigs are slaughtered by inserting a knife just in front of the breast-bone of the animal and directed towards the middle of the pig. In this way the knife is inserted quickly through a depth of from 6 to 8 in., and the main arteries are thus severed. Care must be taken to avoid running the knife between the ribs and the shoulders, otherwise there will be a congregation of blood in that part which will prevent curing from taking place. The arteries which are to be severed are all together just inside the breast-bone, so that a very little preliminary practice will enable a slaughterman to become perfect in this particular work.

THE LARD-ROOM OF AN IRISH BACON FACTORY

The Scalding and Singeing. As the carcase is suspended head downwards, the blood flows out at once, and the whole operation, comprising the shackling, suspending to the overhead bar, slaughtering and bleeding, does not occupy more than two minutes. At the end of the operation,

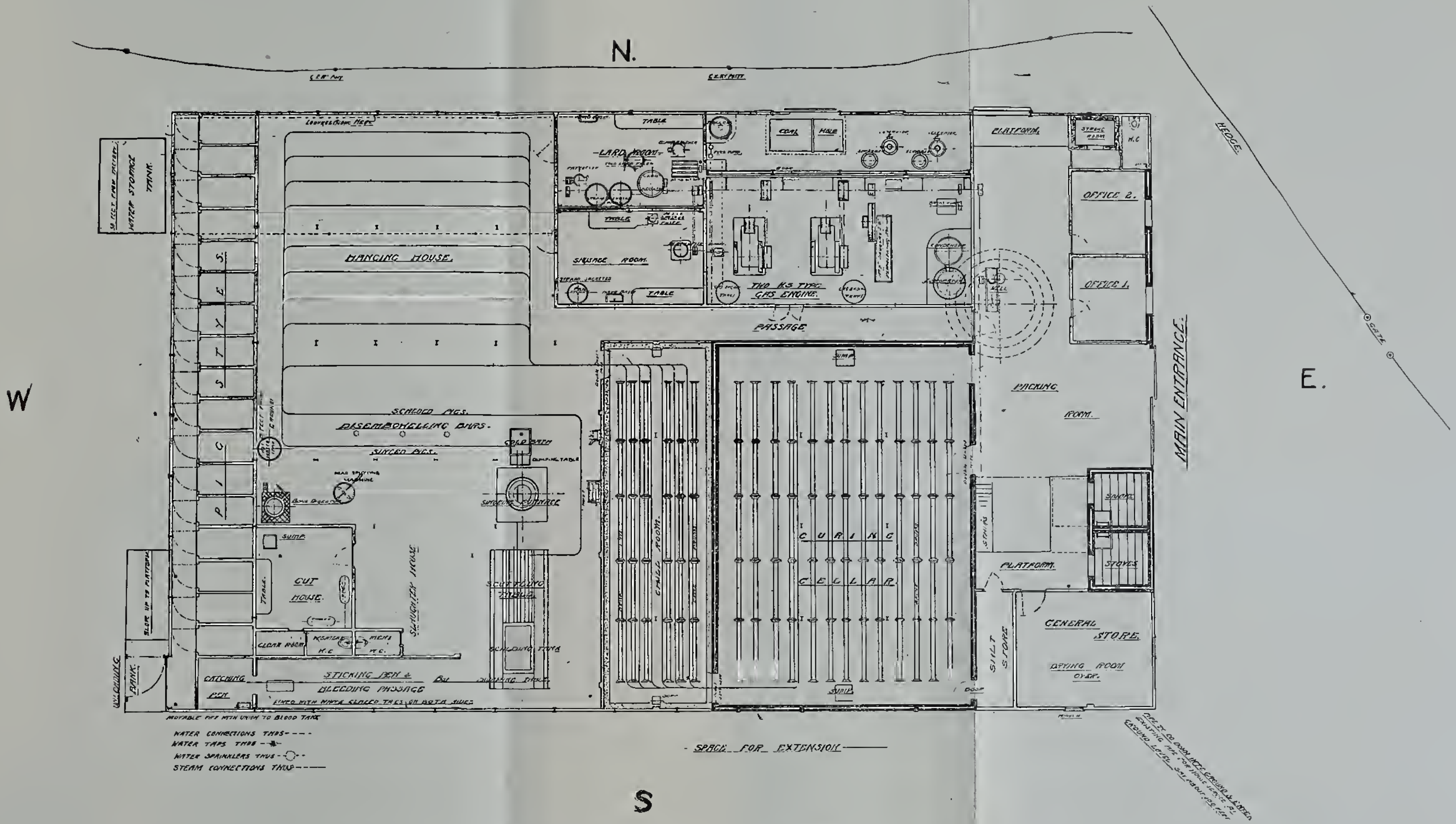
Pigs in Hanging-loft of Bacon Factory
They are hung in this way until the animal heat has dissipated, after which they are put into the chill-room.

when the carcase is free from blood, it is pushed along a track-bar and thrown upon a dumping-table, where the leg-chain, by which it has been shackled, is removed, and it is rolled into a tank which is three-quarter parts filled with hot water, which is maintained at a temperature of from 148° to 180° Fahr., according to the size of pig being handled. The carcase—which we propose to follow throughout the whole of the operations, as indicating what takes place with all the others—is scalded in the vat until the hair comes away easily in the hand, and when this occurs it is then thrown, by means of a tilting-cradle, on to the scuttling-

The Offal-house in an Irish Bacon Factory table, which is a strong, sparred bench fitted on to the end of the scalding-tank. The carcase is scraped on this table, and, as we will assume that the intention is to produce what is known as Wiltshire bacon, it will then be swung by means of a hook fixed in the apex of the lower jaw, head upwards on a track-bar, 7 ft. 2 in. from the ground. The carcase is pushed along this bar until it comes right under the opening of a vertical singeing-furnace. It is then hoisted up through a circular opening containing a strong fire and gets immediately singed. This operation occupies a quarter of a minute. The carcase is then lowered on to the track-bar again and presents a shrivelled-up and black appearance. It is then dropped into a cold-water bath, so as to cool the heated skin. The object of this singeing is not only to remove the hair which may be left, but the excessive heat of the furnace momentarily melts the subcutaneous, fatty tissues and, as a consequence, when the carcase is cooled these portions of the back fat especially present a hard appearance, which is what is desired in Wiltshire bacon-curing.

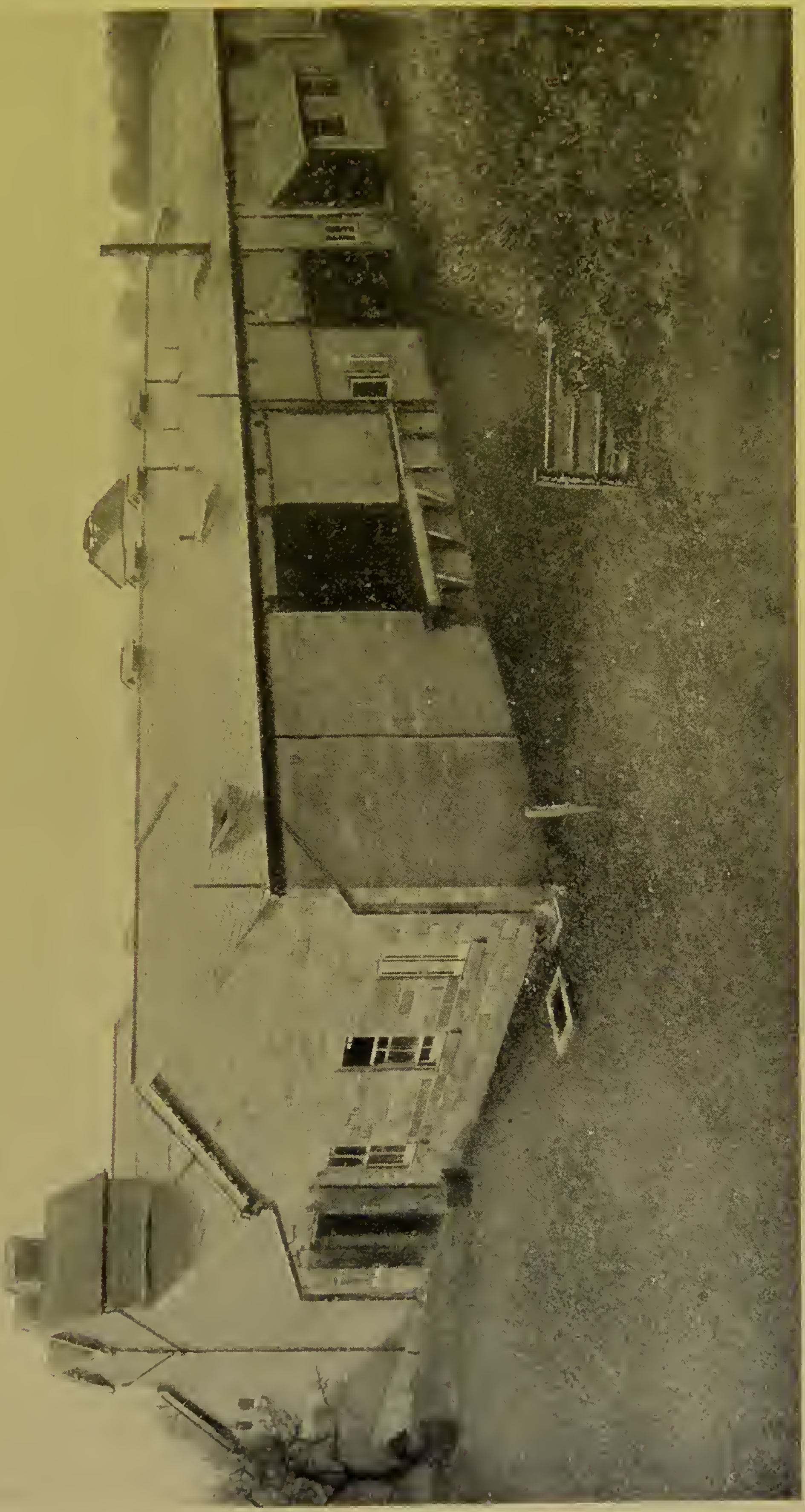
Cleaning out the Carcase. When the carcase has been sufficiently cooled in the cold-water bath, it is lifted by means of the sinews of the hind feet, through which a spreader or gambrel has been placed, so as to extend the hind feet as far as they will go. A hook is placed under the middle of the gambrel and by this means the carcase is suspended to the overhead bar, and is at once scraped clean by means of a flat pig-scraper. It is then washed by overhead sprinklers and may be brushed at the same time, so as to make it quite clean. As soon as this is finished, a long straight cut is made between the hams right down the belly to the opening made by the sticking-knife. Another cut with the knife severs the aitch-bones, and the bladder and internal organs of gestation are removed. The next operation is to remove the crown end, which is carefully cut out, and the fat gut is loosened along the back ; the remainder of the intestinal organs, including the stomach and fat, are then taken out together and are removed to the offal-house, where they are separated and dealt with in various ways. The intestines are cleansed and used for sausage-making. The bladders are cleansed, bleached, and dried, and are used for filling lard. The stomach is either sold to shops, in order to be cooked and sold as an article of food, or it is used for pepsin-making. The liver and kidneys are separated from the rest of the offal and thrown into tubs of running water standing by. The breast-bone is cut down in the centre with a knife or with a saw. The knife is then passed round the skirt as close to the flank as possible, and the heart and skirt are cut from the lungs and thrown into tubs of running water, in the same way as the liver and kidney. The lungs and windpipe are drawn from the breast-bones and severed at the base of the tongue. In some cases the tongue is cut out at the same time as the lungs and thrown into tubs of running water.

The flake-lard is then taken out and thrown over the top of the carcase and the whole is cleansed, this being the final cleansing which the fresh carcase receives.



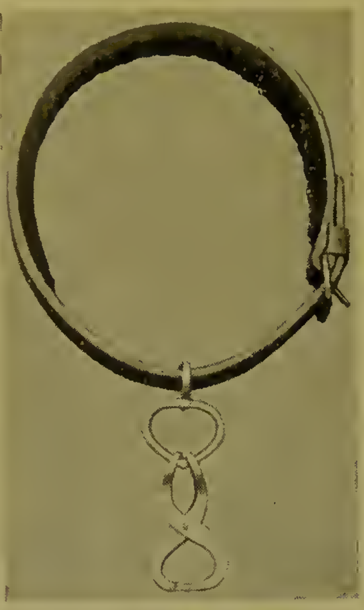
A MODERN BACON FACTORY

The illustration is a copy of the ground plan of the Dunmow Flitch Bacon Factory in Essex, and represents the most approved design in connection with the general arrangement of a modern factory. The pigs are landed at one end of the factory and pass through the various departments, which are arranged in sequence, and the finished products are sent out at the other end, where they are under the immediate control of the offices.



General View of a Modern Bacon Factory at Dunmow, Essex

Severing the Carcase for Curing. The next process is to sever the carcase into the requisite portions for curing. An incision is made from the root of the tail right down to the neck, and this exposes the vertebral column. A second incision is made on the right side of the vertebral column, and the knife is guided right down to the neck as close to the bones as it will go. A third incision is made, and the knife is guided down the left side of the vertebral column. When this has been done, the vertebral column will be exposed in the middle of the first incision made, the flesh of the back being divided away from it by means of the second and third incisions referred to. In this condition the carcase is weighed, and if it is still hot, an allowance, called "beamage," of 3 to 4 lb. according to local custom, per carcase, is deducted by the bacon factory, so as to compensate for loss in weight during the cooling of the carcase. The weight includes the carcase itself with head and feet on and also the flake-lard attached, and this is termed the "dead weight," upon which the price given at the factory is based, there being nothing allowed for the primary offal. When the weighing has been completed, the legs are cramped back with cramping-hooks, so as to enable the subsequent setting of the carcase to give a more compact side and also to shorten the appearance of the shoulder. As a certain amount of blood collects in the head or snout, a cut should be made across it, so that any blood should be allowed to run out. The carcase is then complete and ready to be pushed into the hanging-house, where, by means of a chopper, the backbone is immediately cut out, broken in the middle and hung over the gambrel. The flakes are then flung over the gambrel so as to cool, and the heads are severed so as to be suspended by the neck-joint only. The whole carcase is allowed to hang until it is cooled. Provision is made in a modern bacon factory for a complete hanging-house, where the whole day's killing will be accommodated. The hanging-house should be a lofty, airy place, where there is plenty of ventilation and where the light is derived, if possible, from the north, so that brilliant sunshine may be excluded. The carcase dries in the hanging-house while it is cooling, but excessive sunshine causes the rind to shrivel, and this feature is very objectionable. In ordinary weather the carcase is allowed to remain in the hanging-house from one day until the next, so as to allow of the animal heat dissipating. In this operation, however, a certain amount of judgment is necessary, inasmuch as there will be rapid cooling in cold weather, and it is undesirable, when there is a very low



Blade-bone Drawer

This instrument is used for pulling out the blade-bone in sides of bacon.

COMPONENT PARTS OF A SIDE OF SMOKED WILTSHIRE CUT BACON

5. Smoked Gammon of Wiltshire Side of Bacon

A very fine example of a smoked gammon. The ideal proportions of fat to lean meat are here well shown, also the fine veins of branching fat, denoting breed and judicious feeding. The true and beautiful smoke-colour denotes the great perfection reached in this branch of the modern bacon-curer's business.

6. Middle of Smoked Wiltshire Side

Thick, lean, and streaky ; small flank ; good back ; nice flat rib ; lean meat very richly veined—a handsome middle.

7. Fore-end of Smoked Wiltshire Side

Very thick plump fore-end, and extra fully marbled, but not grossly fat, showing pocket-hole through which blade-bone has been abstracted—a good example of perfect quality.

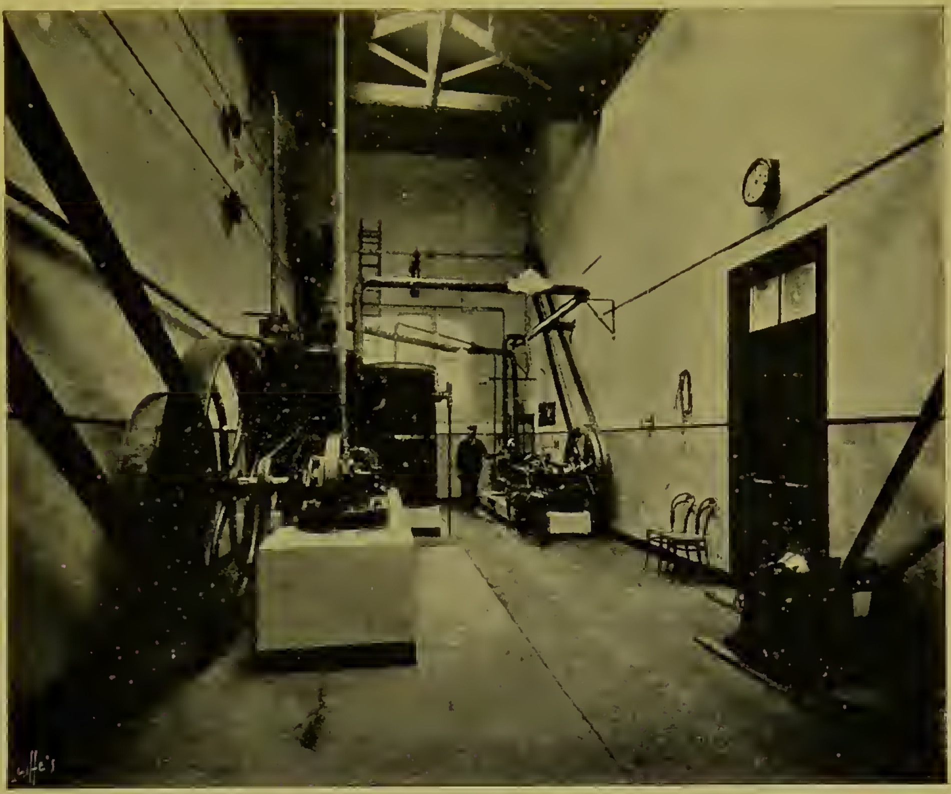
5

6

7

temperature, that the carcases should be allowed to cool down below 46° Fahr.

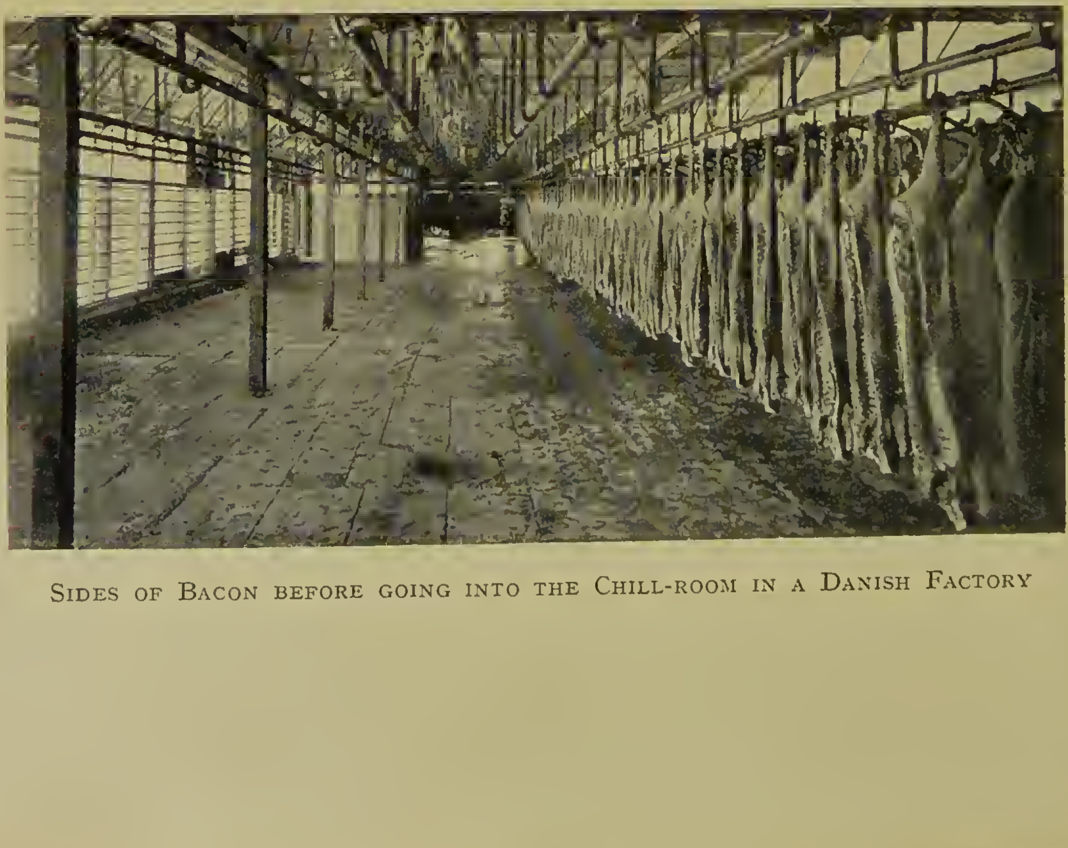
Cutting and Trimming. When the carcase has reached the temperature deemed low enough, about 65° F., the head is cut from the body and the sides are taken off the gambrels, being laid, inside upwards, on tables. They are then trimmed so that all the superfluous tissue is removed, and all bloody portions are taken away from the neck. The steaks, or undercut of the loin, are then removed, and the fore feet cut off at the knee-joint. The neck-bones and aitch-bones are then cut loose, as near to the bone as possible. The spare-rib and breast-bone, going along with the neck-bone and the tops of the ribs, are sawn off. The large vein of the neck is cut out, and the blade-bone is drawn out of the shoulder by means of a blade-bone drawer and with the assistance of a blade-bone chisel. The blade-bone chisel is inserted all round the blade-bone, so as to remove the flesh, and in this way prevent the removal of any meat along with it. The opening made by its removal is termed the "pocket" by bacon-curers, and is looked upon as being a dangerous portion owing to its liability to decomposition.


THE ENGINE-ROOM OF AN IRISH BACON FACTORY

The trimming is completed so as to make the sides look uniform throughout. They are then placed in the chill-room. The object of chilling is to reduce the temperature of the sides to about 38° Fahr., which degree is most suitable for curing. The chill-room is generally a long room constructed with insulated walls and cooled by means of a blast of cold dry air, which is circulated from the refrigerating-machine

Interior of a Danish Factory, showing the Weighing of the Carcases

by means of a fan. It is essential that the air should be dry and in circulation, otherwise the cooling of the sides is not effective. It is usual to ascertain the temperature of the sides by inserting a meat-thermometer at the gammon end, reading off the degree when it has been in position for a minute or two. While the chilling is proceeding, the other work of the factory is taken up by the men who have placed the sides in the chill-room, and they proceed to separate the fat from the meat in the trimmings; blade-bones are collected and cleaned, as are also the feet and heads which have been cut off. The feet and heads may be put into a revolving sparred cylinder called a "head-washer," in which a constant stream of water is allowed to flow, and by revolving



Sides of Bacon before going into the Chill-room in a Danish Factory it any objectionable matter is at once removed. The heads are then split right down, either from the lower-jaw side or through the mouth, and the brains are removed. They are then thrown into a tank of pickle and remain there for twenty-four hours, so that all blood or easily putrefying matter will soak out. They are then pumped with the standard pickle, in the "chap," or lower jaw, and in the "eye-pieces," or upper jaw, and are laid into pickling-tanks, where they are covered with salt and a little saltpetre. The length of time they are kept in cure is not so long as in the case of bacon. They may be kept in stock for several weeks without much loss or injury.

The Chill-room in a Danish Bacon Factory

Injecting the Pickle. With regard to the curing of the sides, this follows upon their being chilled in the chill-room. As soon as the curing temperature has been reached, they are pushed along a bar in the chill-room into the cellars, and are at once thrown upon benches, where they are injected in some fourteen different places with a pickle made from the following recipe :

55 lb. salt.
5 ,, saltpetre.
5 ,, pure cane-sugar.
5 ,, dry antiseptic or boron preservative.

These ingredients are made up to twenty gallons with fresh water and are boiled and skimmed until quite clear. The solution is then allowed to settle and the clear fluid decanted off, care being taken not to syphon over any of the deposit. The pickle thus formed should test about 100°

Pumping Bacon in Denmark

In Denmark only Wiltshire sides of bacon are produced, and the bacon is all pumped before being placed in the curing-bed and covered with salt and saltpetre.

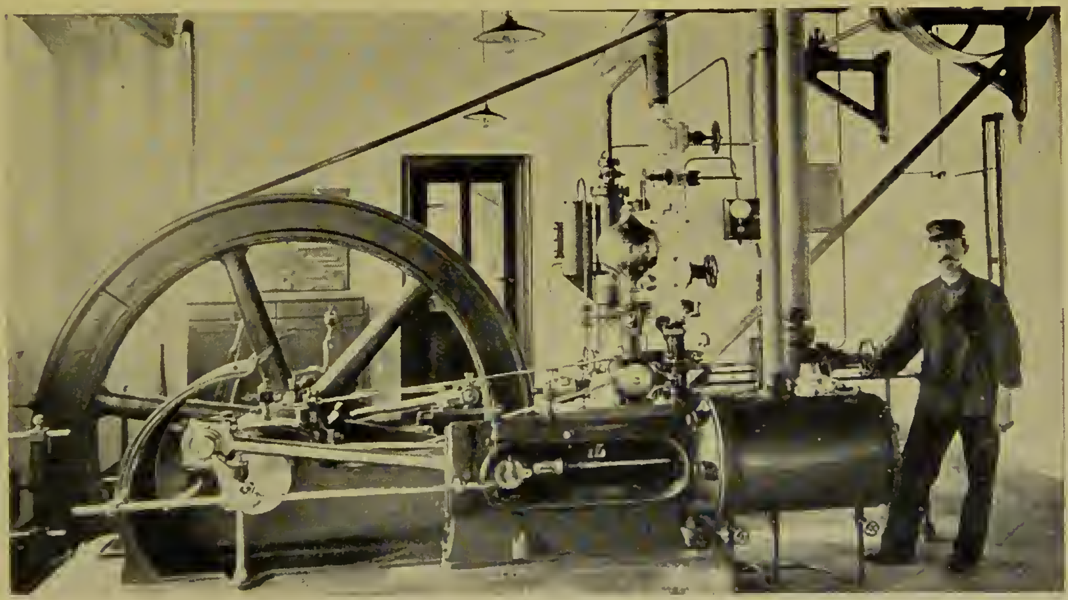
on Douglas's salinometer, and if it is not up to that strength, salt must be added to make it so. This pickle is used for many operations in a bacon-curing factory, and should be prepared with the greatest possible care. It should be tested from time to time so as to ascertain if its strength is maintained, and it should never be used unless it is at the same temperature as the curing-cellar. The quantity of twenty gallons is taken as a suitable unit, but it can be added to and made to suit

The Cellar of a Danish Bacon Factory

This illustration also shows the meat undergoing the process of pumping.

Danish Bacon Factory: Room in which the Hogs are singed

The Hanging-room in Herning Bacon Factory, Denmark



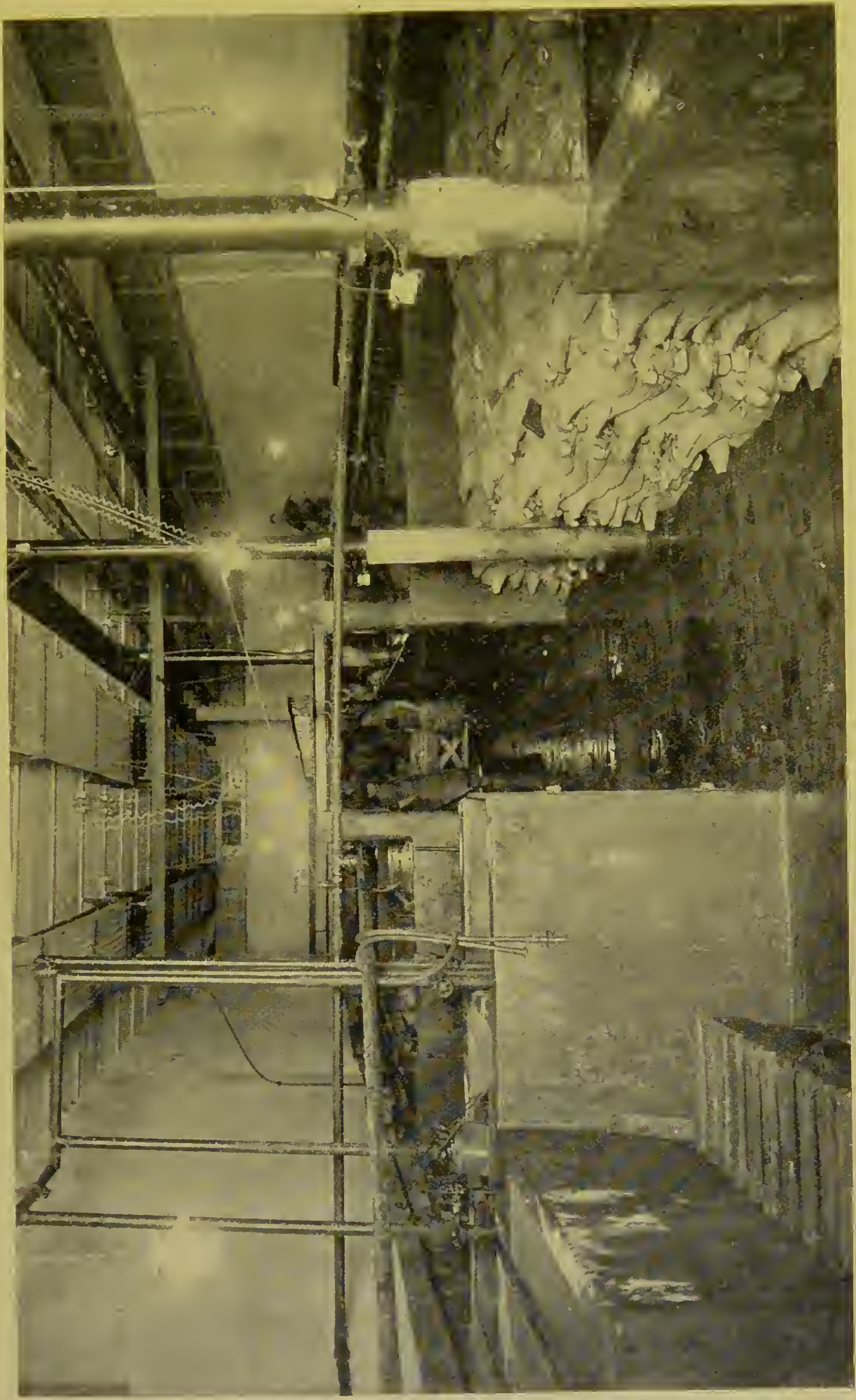
The Engine-room in a Danish Bacon Factory any dimensions by simply multiplying the figure by the same common denominator. In some factories it is usual to have a large tank for storing up the pickle, and this enables a very uniform article to be always ready for use.

The pickle-pump is an apparatus constructed like an ordinary force-pump, and is used to inject the pickle into various portions of the meat, the working pressure being about 40 lb. to the square inch, and this is indicated by means of a pressure-gauge. The needles which are used for injection are so constructed that the outflow of the pickle is controlled by a thumb-valve, and the pickle is injected through the needle, in which a number of holes are made for the purpose.

The Time required for Curing. The pickle having been prepared, the sides are laid on tables, and when the feet have been sawn off at the hough-joint, the blade-bone pocket is filled with dry salt and the pickle is pumped into the fleshy parts of the meat in the manner described. When this has been completed, the whole of the cut surfaces of the sides are then brushed with pickle, a soft-haired brush being used. The sides are then carefully carried to the curing-bed and laid down there, cut surfaces upwards, with a few staves under the belly part so as to maintain the hollow of the ribs and ensure that the flank part of the side will be raised so as not to take up an excess of salt. The sides are then sprinkled with an equal mixture of saltpetre and dry antiseptic, and over this is placed a layer of salt ; they are placed, one by one, right and left on the top of one another, five pigs high or ten sides, and are left in that position until the curing is complete. This occupies a period of from seven to fourteen days, it being altogether governed by the demand for very mild-cured meats. In fourteen days the curing will be mild, but there are places where this short period of cure does not produce an article which is quite mild enough, and therefore a shorter period in the salt is given. In Denmark the cure is often from eight to nine days, and in Ayrshire it is sometimes as short as three days. The temperature of the curing-cellar should not be higher than 42° Fahr.

The Finished Article. When the curing is considered complete the sides are "struck," that is to say, they are taken from the piles, turned up and thrown on to a sparred low table called a "horse," and this permits of the pickle and salt still lying in the hollow of the ribs and also on the sides, to drain and fall off ; the pockets are generally then emptied of salt, this being either scooped out or washed out with some old brine from the pickle-pumps. The sides are then carried to the baling-room, where they are washed in a solution of water to which a small quantity of dry antiseptic has been added. They are then dried, care being taken to remove any slime that may have gathered.

In countries where bacon is made for export, the bacon known as "Wiltshire" cut is now ready, and is classified in various selections according to the market for which it is intended. If the bacon is produced in the United Kingdom, it would still be selected in the manner suggested, but it might also be smoked and sold as smoked bacon. The

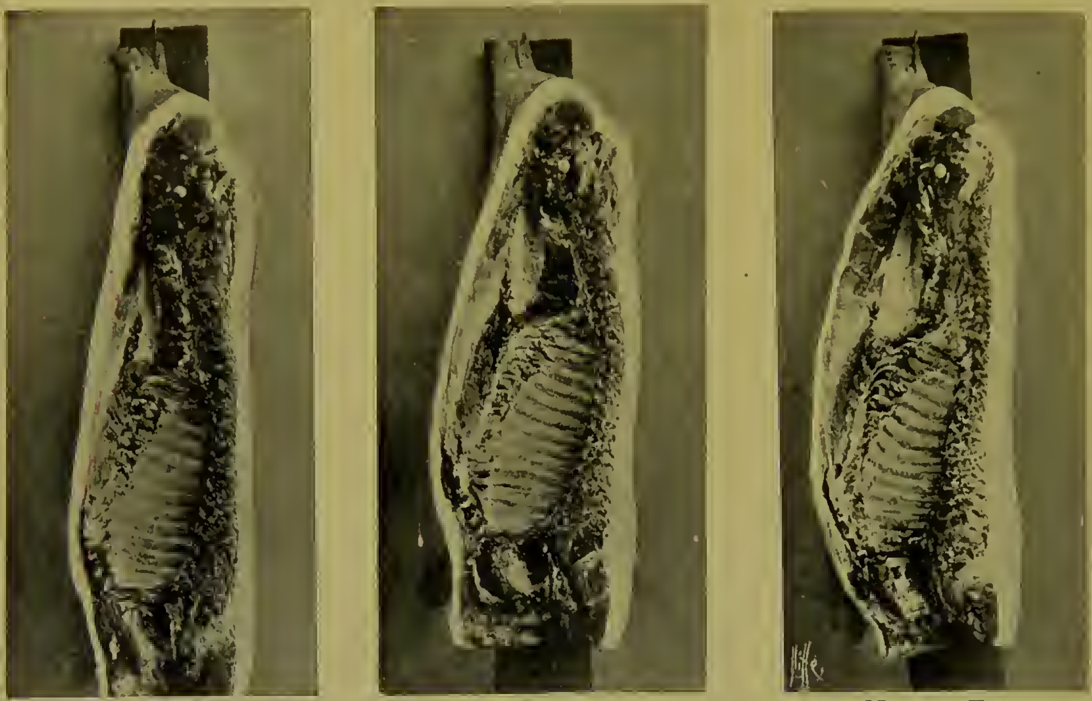


Danish Bacon-curing Cellar

In this illustration the bacon is shown piled in sides, and large concrete pickling-tanks for curing by the wet process are also to be seen.

smoking process is conducted in smoke-stoves, which are so constructed as to give a cool smoke and which is derived from smouldering oak or hard-wood sawdust. The smoking process occupies about three days, and the temperature is maintained at from 85 to 95° Fahr.

Imported bacon may be handled as smoked bacon, that is to say, after it has been received in this country it may be smoked, and this custom has given rise to a separate industry, namely, the smoking of bacon.



No. 1.—Lean Sizable. No. 2.—Medium. No. 3.—Fat.

Typical Sides of Danish Bacon

The bacon to be smoked is generally dusted over, previously to being hung in the smoke-stove, with pea-meal; this gives it a peculiar flavour and, at the same time, is considered to enhance the smoked appearance.

Bacon is generally packed in either four sides to a bale or six sides to a bale, according to the size and weight of the pigs.

TAINT IN HAMS AND BACON *

Although such vast quantities of ham and bacon are produced, there has been very little attempt to understand the actual processes which occur in the transforming of the fresh pork into the finished article. The process of curing has varied very little for centuries, and the only difference between the present-day system and that which was in vogue a century ago consists in using less salt than formerly; so that whereas cured meats at one time were heavily salted, they are now lightly salted —in order to produce what is called "mild-cured bacon" or "mild-cured hams."

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* *Journal of the Royal Society of Arts*, 1908. By London M. Douglas.

LOG OF CHILL ROOMS AND CELLARS.

DATE,..

No. of Pigs Killed .... Time of Killing... ... .

Outside Temperature at 6 a.m..................................... At 12 Noon. . . ..

	CHILL ROOMS.				CELLARS.			
	No 1.	No. 2.	No. 3.	No. 4.	No. 1.	No. 2.	No. 3.	No. 4.
Temperature at 6 A.M.								
Moisture								
Temperature at 12 noon								
Moisture								
Temperature at 6 P.M.								
Moisture								
Temperature at 12 midnight, if working Machine								
Temperature of Room before putting in Pigs								
Moisture								
Temperature of Pigs when put in								
Temperature of Pigs at time of Salting ...								
Moisture of Room when Pigs taken out . .								

Temperature of Pickle when used .. ..

Strength of , „

REMARKS.

One of the secrets of success in modern bacon-curing lies in the constant and accurate observation of the temperatures of the chill-rooms and cellars and the moisture or humidity present in the air. The "log" should be kept carefully and written up every day, without fail.

It is a mistake, however, to suppose that the mere dissolving of the salt, or any other ingredient which may be placed on the fresh meat, has the effect of "curing" the meat. It has no such effect, but really only prevents the development of the germs of putrefaction.

The Taint-producing Germ. In this connection it is interesting to note that the germ which produces taint in meat has been isolated. We are indebted to Dr. Klein for accomplishing this result, and his notes on the subject are of the most interesting character.

Dr. Klein states that his examination of the muscular tissues of tainted meats showed that they were more or less discoloured. In very slightly tainted portions the colour changed to a pale or dirty grey tint, while in strongly tainted portions the colour approached dirty green, and the microscopic examination of the muscles disclosed the fact that *tyrosine* was present. The origin of this crystalline nitrogenous product is somewhat obscure. It was discovered by Liebig in animal tissues, and attributed by him to decomposition of the albuminous substances present.

The notable feature is that in the presence of taint a very powerful and objectionable odour emanates from the joints.

In the various specimens of tainted meats examined it was found that a species of microbe predominated everywhere, and more especially in the parts which were highly tainted. These microbes exist in the form of cylindrical rods, only visible to the eye by means of a powerful microscope. But the same appearances occur throughout the connective and fatty tissues of the meat, and, if the tissues are undisturbed, the rods will present the appearance of being continuous, but very easily get broken up into short segments.

The "Bacillus Foedans." This particular microbe, which Dr. Klein has named *Bacillus Foedans,* is not possessed of the power of moving, such as is characteristic of many other germs, but must rely for its progress on gradual multiplication. This feature, therefore, explains why it aggregates in some parts more than in others. The microbe is incapable of growing freely in the air or if it is exposed to oxygen (anærobic), and it is also incapable of forming spores and, curious to say, the ordinary methods of culture of micro-organisms seem to be quite useless in this particular case, inasmuch as the usual media do not seem to support its growth.

The principal characteristic, however, of the experiments which have been made is that, while the germ grows in a substance like milk, a most disagreeable odour is emitted. Subcutaneous injection in guinea-pigs did not produce any local or general disease, thus showing that the germ has no injurious effects.

Helpful Investigations. The facts which have been established in these investigations are very helpful in the process of curing. There can be no doubt that the germ is the result of decomposition, which may be set up in several ways. If the meat is insufficiently chilled before the curing agents are used, or if the animals have been slaughtered immediately after a journey in which they have been knocked about,

THREE-QUARTER SIDE OF DEVON BACON

MATURED WINTER-CURED HAM

HAMS PRODUCED FROM MILK-FED BACON IN DEVONSHIRE then putrefaction will almost certainly supervene. These germs, however, may be taken up in the cellar itself, and, as they are so very small that some hundreds of thousands of them can rest on the point of a needle, then it will be understood that once they have obtained a location in a cellar they are apt to remain there.

We are of opinion, however, that the development of taint can be prevented by inhibiting the propagation of these germs by immediately pumping an antiseptic solution into the bacon and hams, and for this purpose we have found that the best antiseptic mixture consists of 55 lb. of salt, 5 lb. of saltpetre and 5 lb. of dry antiseptic (boron preservative). This mixture should be made up to twenty gallons with water, boiled and stirred till clear, then allowed to cool to the same temperature as the cellar.

We are familiar with the objections which have been raised to the use of boric acid in any form, but they seem to be empirical to a large extent, and not possessing any real virtue—the result, in fact, of mere prejudice.

Curing Agents. Such an inhibitory solution, if injected into bacon, enables decomposition, as it proceeds, to be delayed until the tissues become saturated with a solution of the curing agents. These curing agents consist generally of salt, saltpetre, and a preservative in solution.

We have found in many cellars that the liability to taint is greatest when the atmosphere is in a stagnant condition, and is thus liable to encourage the propagation of moulds and similar organisms, and it is invariably the case that when once taint attacks a cellar, it is with the greatest possible difficulty that it can be eradicated without having recourse to strong measures.

The remedy is to clear out the cellar and, after closing up all the apertures, evaporate within it a strong volatile germicide. We have found one or two of those to be highly effective, and when evaporated they search into the crevices of the cellar, and so destroy any germs which may be lurking there.

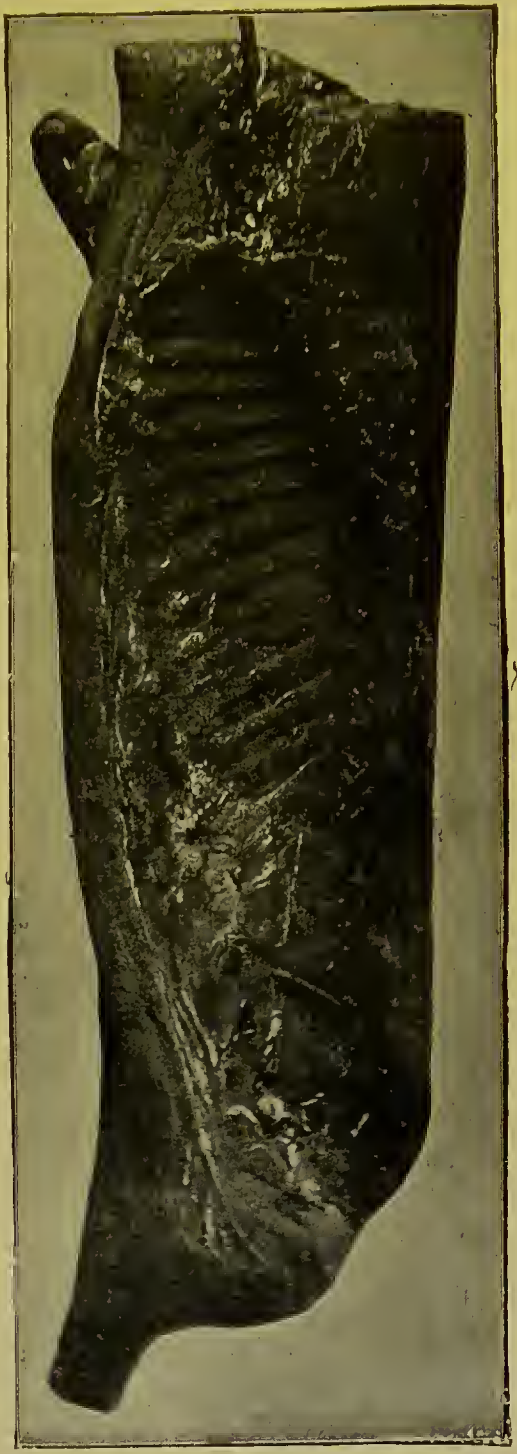
After this cleansing process has taken place, it is a wise thing to lime-wash the roof and sides of the cellar, and we are inclined to think that this should be done at least once a year, as there is now a machine available which enables lime-washing to be done very rapidly, and we think it ought to form an annual operation in all bacon establishments.

HAM-CURING

Ham-curing is closely allied with bacon-curing, and is practised all over the United Kingdom, as well as in all bacon-curing countries. It is more especially developed in the United States, where pig-products are more utilised than in any other country, and where it is not the general rule to cure whole sides of meat, such as obtains in Europe.

Ham-curing necessarily means that the part of the side from which the ham is severed has to be handled as a separate article, and is some-

Pale Dried Side of Wiltshire Bacon



Smoked Side of Wiltshire Bacon

times cured as a "long side" for the purpose of making "rolled bacon," or it may be cured as a long side for pale-dried or smoked bacon.

The curing process is, however, practically the same as has already been described in connection with Wiltshire bacon, and the general principles laid down for the handling of that commodity apply to all other kinds of bacon which are produced, such as middles, long ribs, Cumberland middles, clear bellies, and backs of bacon.

The hams may be of a particular shape, according to the locality in

Gammon End of a Side of Bacon

which they are produced, and may either be "short cut" or "long cut." They may have a round appearance, generally associated with Staffordshire hams, or they may be cured according to the Yorkshire and Cumberland methods of winter curing. There are, indeed, a great many varieties of hams, but the principles of curing do not vary very much. The principal kinds of ham produced in the United Kingdom are "long cut," which may be either winter or spring cured, and may be pale dried or smoked.

The winter-cured ham, however, may be matured until it possesses what is called in the trade a "bloom," but this characteristic feature is simply a development of a common mould (*Penicillium glaucum*), which very easily develops in damp places, and more especially on such favourable surfaces as those of hams.

In Ireland, especially, what are termed "Yorkshire hams" are produced in considerable numbers for the Paris markets; they are generally of small weights (15 lb. average) and command a very large price in France. In the north of Ireland, on the other hand, the average weight of a ham cured is 15 to 20 lb., and there are also many cured that are heavier. In Cumberland the weights are of an average of about 20 lb., but among the farmers 40 lb. is not an unusual weight for a winter-cured, matured ham.

The same remark applies to Yorkshire, where, on the farms, winter curing of hams is practised to a considerable extent. In Scotland, again, winter curing is carried on in Ayrshire, but matured hams are not much in demand there, so that the curing is of the mild description, which involves a short time in salt but necessitates a quick consumption.

In the east of England, in Suffolk and Essex, very small hams are cured, and these are generally recognised as being characteristic of that district by their being very heavily smoked; in fact they appear to be almost black.

The processes in the curing of various hams are practically identical, the various cuts and local features being subservient to the cure itself.

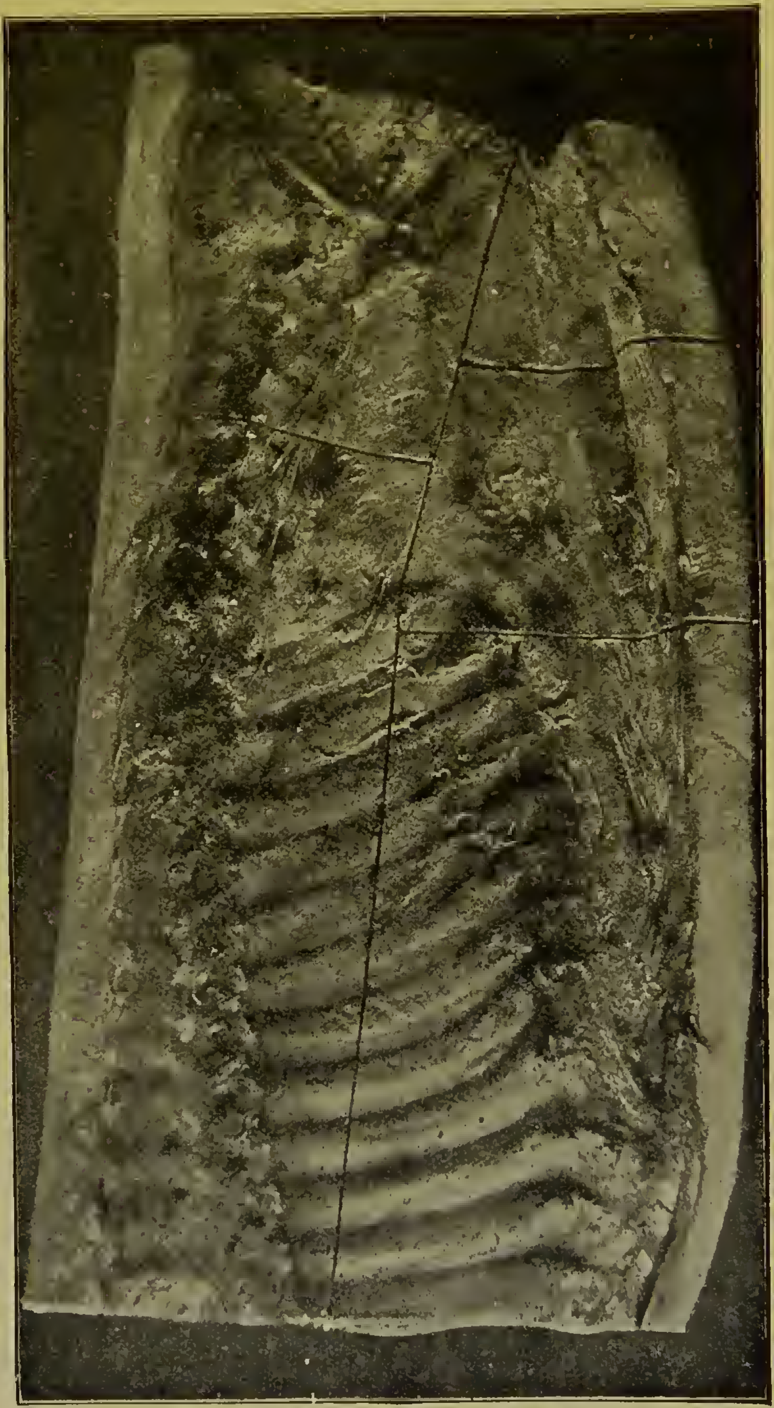
Curing of Hams. First of all, the hams must be properly trimmed, according to the particular cut desired. A skilful workman, in cutting a long-cut ham, will give it the permanent shape with one swoop of the knife, and very little trimming in such a case would be necessary.

The fresh hams should be chilled in the chill-room, at a temperature of 38° Fahr., and a meat-testing thermometer should be brought into use in arriving at this degree, as it is very important that there should be no doubt at all about the meat being chilled throughout.

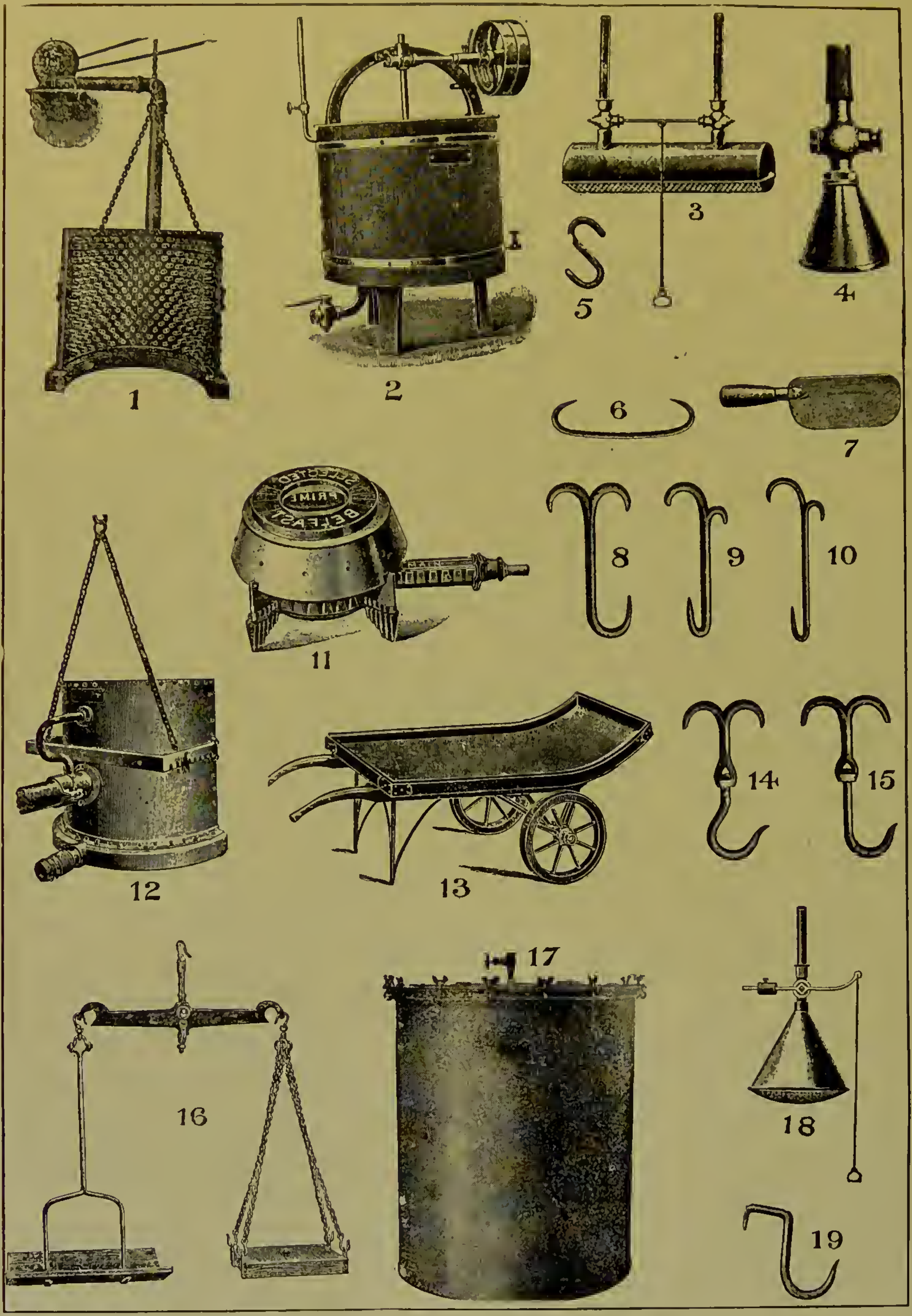
As in the case of bacon, the curing-cellar should be about 42° Fahr.

The first thing to do is to squeeze out any excess of blood which may be present in the blood-vein, and it is a very good plan to pump into this vein, by means of a pickle-pump, a little of the pickle made from the recipe already given.

This pickle is used for ham-curing in the same way that it is used for bacon-curing. A quantity of it is specially reserved for purging hams, that is to say, that when they are

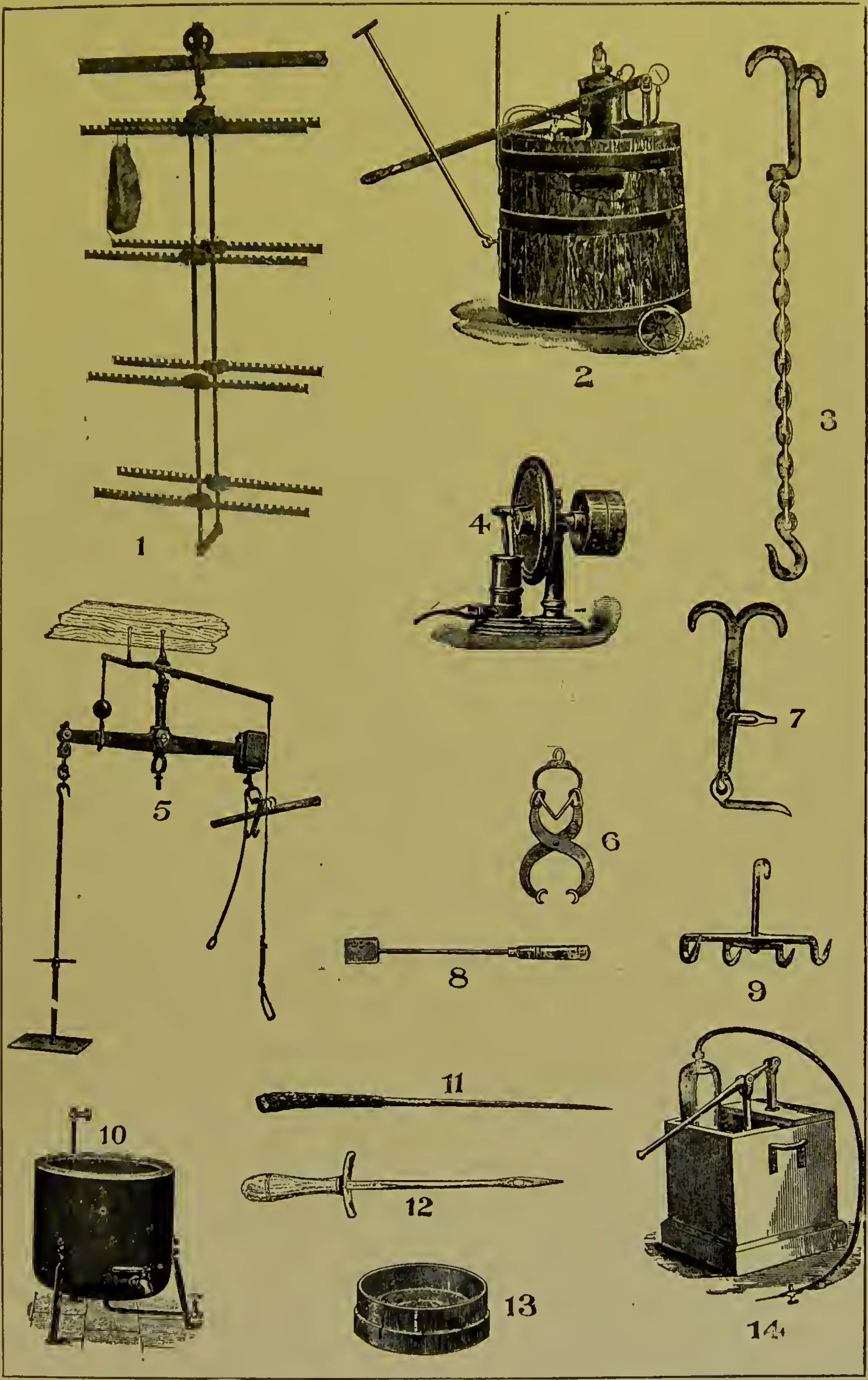


Middle of a Side of Bacon, showing how to profitably cut it up



BACON-FACTORY TOOLS AND APPLIANCES

1, saddle-back singeing-furnace, inside view; 2, lard-agitator and cooling-pan; 3, water-sprinkler for washing pigs' carcases after they have been singed; 4, thumb-valve rose for sprinkling water over carcases of pigs on scuttling-table; 5 S hook; 6, 8, 9, 10, 14, 15, different types of hooks; 7, flat pig-scraper; 11, ham and bacon brand for gas; 12, saddle-back furnace, outside view; 13, bacon-truck for use in the factory in transporting cured sides from the bacon-bed; 16, bacon-scale; 17, mudgeon or rough fat boiler; 18, water-sprinkler for washing pigs after being singed; 19, hanging-hook for attaching to overhead beam.



Bacon-factory Tools and Appliances

1, ham-tree for suspending cured hams in smoke-stoves; 2, pickle-pump for factory use; 3, chain-hooks for hoisting live pigs to slaughtering-bar; 4, bladder-blower for inflating pigs' bladders; 5, scales for weighing carcases of pigs on the bar; 6, blade-bone catcher; 7, drop-hook for hoisting live pigs to slaughtering-bar; 8, blade-bone chisel; 9, middle-hook for suspending middles of bacon in smoke-stoves; 10, pickle-boiling pan; 11, bacon and ham trier; 12, ham-stringing needle; 13, sieve for sprinkling saltpetre, &c., over bacon (the same type is also used for sprinkling pea-meal over cured sides); 14, pickle-pump for small factory use.

nicely trimmed, they are thrown into this pickle and allowed to remain from one day to another, until the blood which may have remained in the blood-vein has been purged out, and the hams are then ready for curing.

Many curers, however, do not take this initial step, and as a consequence suffer considerable loss from taint. If purging is resorted to, it would be necessary to again squeeze out the contents of the blood-vein before starting to cure, and when this is done the hams are laid diagonally, side by side, on the cellar floor, the broad ends resting on banks of salt so as to keep them higher than the shank ends.

While in this position, the hams are dusted over with an equal mixture of dry antiseptic and ground saltpetre, and over the top of this a layer of fine salt is spread, and the hams are allowed to remain in this state for specific periods, according to the class of ham it is proposed to produce.

Ordinary mild-cured hams will be produced by leaving the hams in salt for twenty-one days, but a very good rule to follow is to keep the hams in salt one day for every pound in weight. This would give a mild cure. A ham for maturing, however, requires just double the length of time in salt.

It is assumed in these observations that the curing will be conducted in a modern curing establishment where refrigerating machinery is available, but where it is not so, the conditions are altered, and, on the farm particularly, the curing of hams without refrigerating machinery can only be conducted during the winter months. Farm-cured goods, however, are rarely, if ever, cured in the mild state, but they are generally produced as winter- or spring-cured hams, four to six months old.

In Scotland, especially, the curing of hams is conducted by the wet process, that is to say, the hams are held in pickle from first to last, and

Devonshire Smoked Bacon : Dairy-fed

Selecting the Bacon before sending it out

they are distinguished in this respect from the dry-cured hams already mentioned.

When the curing is complete, the hams are taken out, either from the pickle or from the dry-salting bed, and hung up to drain, so that any excess of pickle will drain off.

If they are then wanted as pale-dried hams they are hung in a drying-room, which is kept at a temperature of about 85° Fahr. Such rooms are either without any windows at all, and depend for their light on artificial lighting, or they are fitted with windows glazed with crimson-tinted glass, so that the sunlight will not be admitted. This is a great advantage in the prevention of flies, which become very troublesome in the drying-rooms when they once obtain access there, as these pests of nature are responsible for the destruction of large quantities of dried hams.

The pale-drying of hams may either take place so as to leave the natural colour of the meat, or the goods may be sprinkled with a little flour so as to give them a brighter appearance.

The whitening of the fat is also considered to be advantageous, and frequently hams are just slightly scalded for about half a minute before being hung up to dry in the drying-room. This, undoubtedly, gives a whiter appearance to the fat.

The smoking of hams is conducted in smoke-stoves, where hardwood sawdust is allowed to smoulder away and the tarry matter in the smoke deposits itself upon the hams, giving them a brown appearance and, at the same time, making them less susceptible to decomposition. The tarry matter contains a portion of pyroligneous acid, but it has also been shown that the active preserving principle present consists of formic acid, derived from the sawdust.

The flavour of the hams may be altered by the addition of juniper berries, coriander seeds, laurel, bay-leaves, and pepper-corns to the curing pickle. This practice is very often carried out in connection with the curing of hams for Christmas sale, at which times these are wanted with more of a piquant flavour than at other times of the year.

In order to obtain this piquancy, a mixture of the ingredients is made in about equal proportions, and put into a cotton bag containing about 1 to 2 lb. in all: the mixture is allowed to float on the top of the curing pickle, and in this way the flavouring juices slowly dissolve out.

CLASSIFICATION OF BACON AND HAMS

Hitherto the judging of bacon and hams has rested upon an extremely unsatisfactory basis, and in this respect has been somewhat like the curing processes themselves.

Curing has now, however, been reduced to scientific principles, and the rule-of-thumb methods, which obtained for so long, have almost entirely disappeared.

In comparing the various qualities there is still confusion, and we have therefore attempted to give here a comparative scale of points which would apply to bacon and ham products.

We would suggest that bacon and hams for judging purposes should be divided up into seven classes, as under:

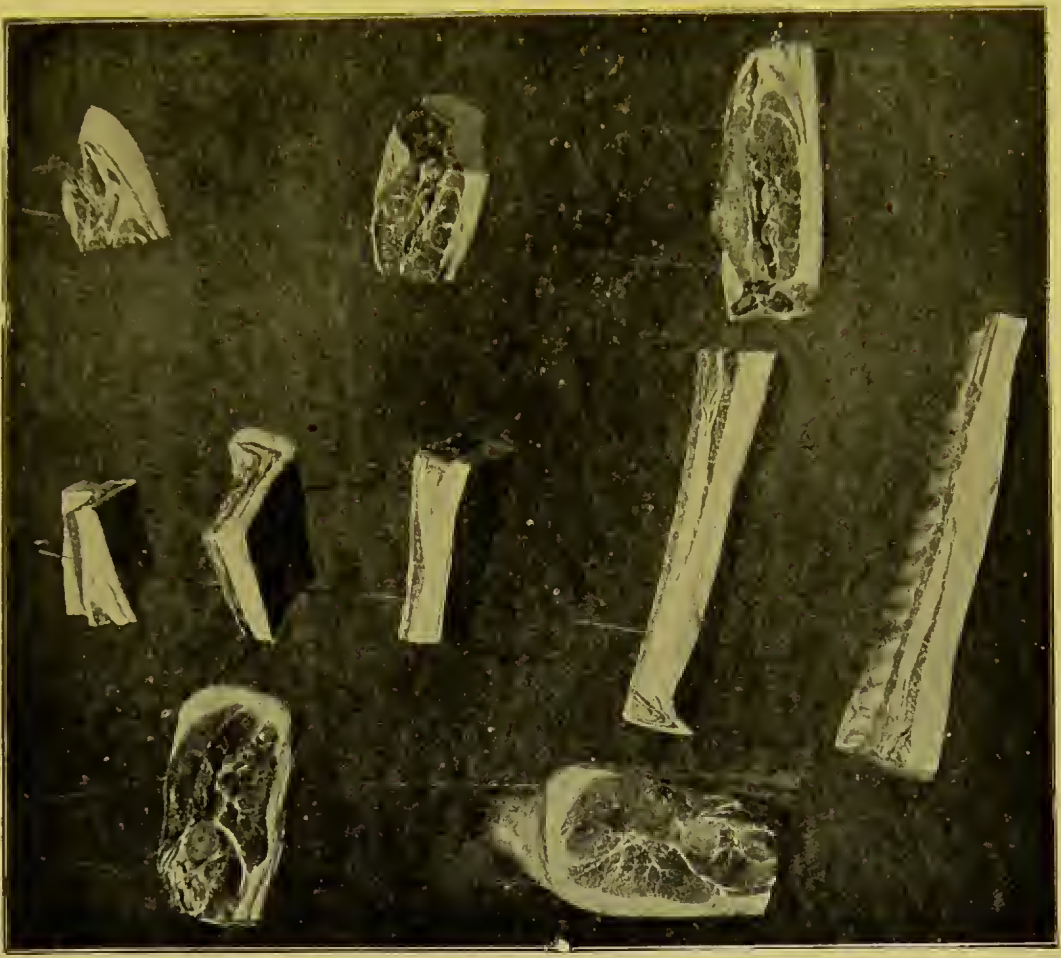
Class 1: Pale hamless sides, of winter or spring cure.
2: Smoked sides, mild-cured in Wiltshire style.
3: Pale sides, mild-cured in Wiltshire style.
4: Pale hams, long-cut, of winter or spring cure, not over 14 lb. weight.
5: Pale hams, long-cut, of winter or spring cure, over 14 lb. weight.
6: Smoked hams, long-cut, mild-cured, not over 15 lb. weight.
7: Pale hams, long-cut, mild-cured, over 15 lb. weight.

The points of excellence for bacon would be as follow:

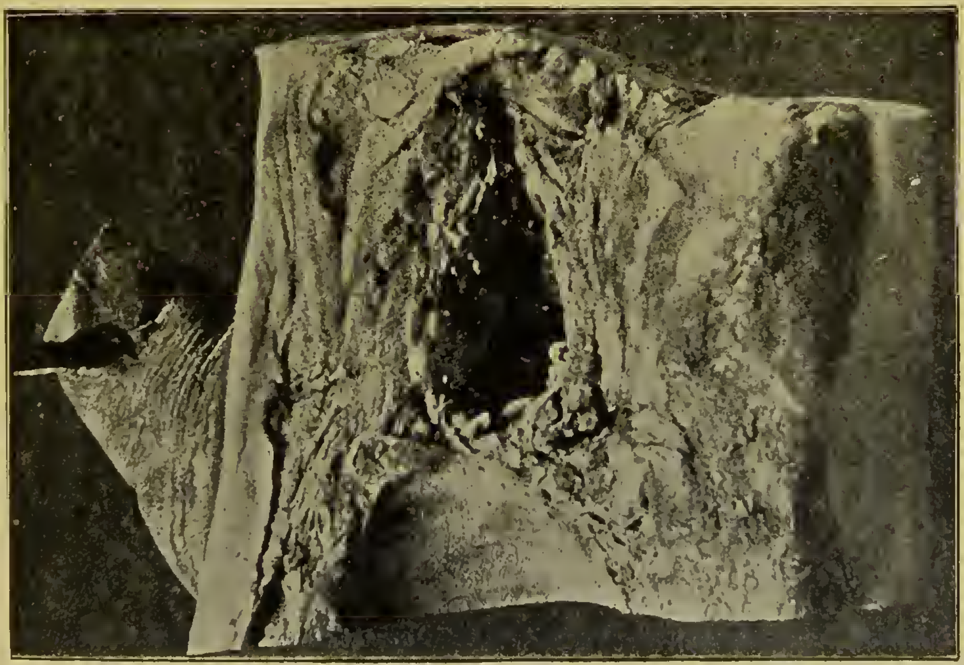
POINTS OF EXCELLENCE

Long Side of Bacon

	Points.
Style and workmanship	20
Streakiness	10
Back	10
Fore-hough	5
Collar	5
Gammon	7

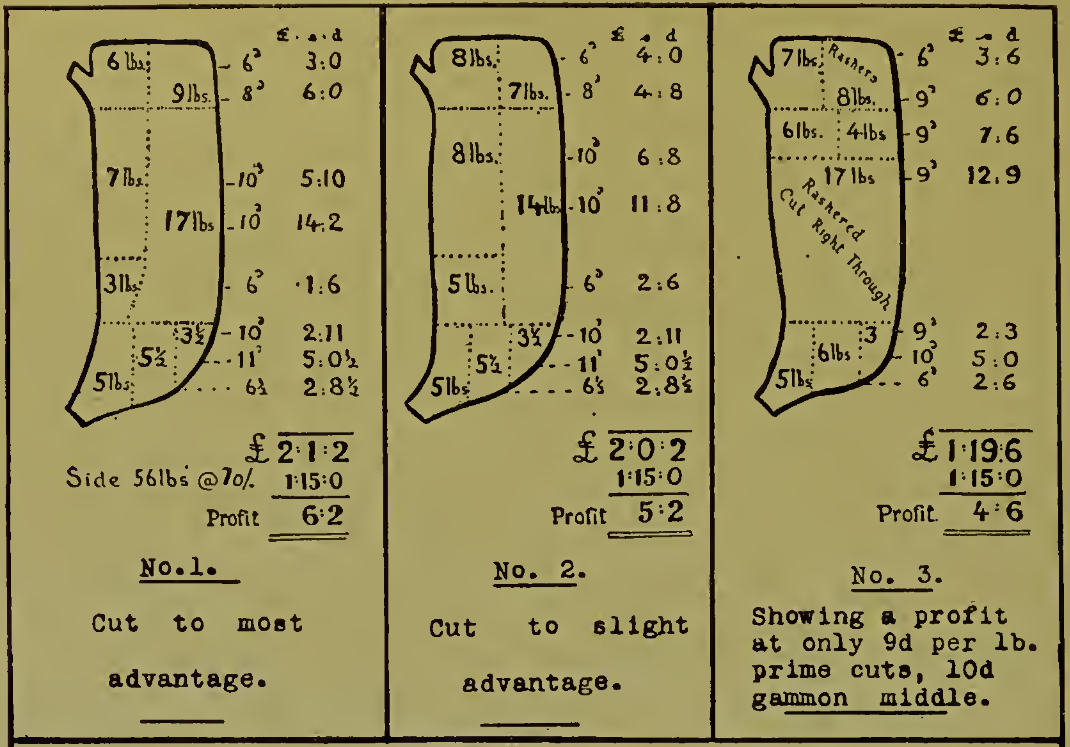


THE ACTUAL SECTIONS INTO WHICH A SIDE OF WILTSHIRE BACON IS CUT



SHOULDER OR FORE-END OF A SIDE OF WILTSHIRE BACON

Firmness of fat	8
Fineness of rind	5
Quality and texture	10
Flavour	10
Colour	10
Total	100



No. 1. Cut to most advantage.

No. 2. Cut to slight advantage.

No. 3. Showing a profit at only 9d per lb. prime cuts, 10d gammon middle.

The cutting up of a side of bacon weighing 56 lbs, and costing 70/- per cwt.

The points of excellence for mild-cured hams would be as follow:

	Points.
Style and workmanship	20
Fulness of lean meat	15
Firmness of fat	10
Fineness of bone	10
,, rind	7
Mildness of cure	10
Flavour	10
Quality of meat	8
Colour	10
Total	100

In judging winter-cured hams, as compared with those which are mild-cured, it would be necessary to take cognisance of the evidences of maturity or "bloom," and in this respect the comparative freshness

Irish Bacon-factory Produce

of hams in relation to the length of time they have been kept should be regarded as the principal feature.

PROFITS ON BACON

Much has been written on the subject of the profits to be derived by the retailer on the selling of bacon, and actual figures are published from time to time showing what such profits are likely to be.

Apparently the retailer finds that when bacon is selling at a high wholesale price, such as 76*s.*, it is difficult to make more than the actual price paid for it to the merchant.

Two statements * are given below, which illustrate the products from different sides :

	s.	*d.*
7 lb. 1 oz. gammon hock, at 8½*d.*	5	0
5 lb. 4 oz. corner, at 11½*d.*	5	0½
7 lb. 8 oz. fore hock, at 6*d.*	3	9

* *Grocers' Gazette*, July 18 and 25, 1908.

General Assortment of Bacon-factory Produce

		s.	d.
6 lb. 10 oz. collar, at 8*d.*		4	5
3 lb. flank, at 6½*d.*		1	7½
6 lb. 3 oz. streaky, at 9*d.*		4	7½
2 lb. 5 oz. long back, at 1*s.*		2	4
1 lb. 11 oz. oyster piece, at 9*d.*		1	3
3 lb. 13 oz. top ribs, at 10½*d.*		3	4½
8 lb. 5 oz. middle back, at 11½*d.*		8	0
1 qr. 23¾ lb.	£1	19	5
1 side, 1 qr. 24 lb., at 76*s.*, cost	1	15	4
Profit		4	1

7 lb. 1 oz. gammon hock, at 8½*d.*		5	0½
5 lb. 4 oz. corner, at 11½*d.*		5	0½
7 lb. 8 oz. fore hock, at 6*d.*		3	9
6 lb. 10 oz. collar, at 8*d.*		4	5
3 lb. flank, at 6½*d.*		1	7½
6 lb. 3 oz. streaky, at 9*d.*		4	8
2 lb. 5 oz. long back, at 1*s.*		2	4
1 lb. 11 oz. oyster piece, at 9*d.*		1	3½
3 lb. 13 oz. top ribs, at 10½*d.*		3	4½
8 lb. 5 oz. middle back, at 11½*d.*		8	0
1 qr. 23¾ lb.	£1	19	6½
1 side, 1 qr. 23¾ lb., at 76*s.*, cost	1	15	1½
Profit		4	5

It must be borne in mind that these figures do not allow of any wastage, so that apparently the retailing of bacon, when markets are ruling high, must be regarded as a somewhat unprofitable business. The price of 76*s.* per cwt. is, however, abnormally high, and 70*s.* per cwt. may be taken as nearer the average. The table given on page 218 shows how at this price there is a considerable profit to the retailer, which may be augmented by the careful handling of the meat.

BOOKS AND STATIONERY USED IN A MODERN BACON FACTORY

The various books which are used in connection with a bacon factory have to be carefully planned, as the business involves a good deal of book-keeping, so as to ensure a proper check on the products throughout. The actual headings used in connection with this particular business show what is considered necessary by bacon-curers as exhibiting the various processes of manufacture and accounting.

With regard to the purchase of pigs in the open market, this operation can better be understood by the giving of actual sale notes, showing transactions which have taken place in Birmingham market. It will be observed that the consignment of pigs referred to is from Ireland to Birmingham, and this fairly represents the kind of transaction which takes place with pig-buyers in Ireland and their agents in the United Kingdom.

Another important matter in connection with bacon-curing factories is the monthly price-list, and copies of actual price-lists are appended showing what the custom is in this respect. These represent an Irish price-list, which is the first given, and a leading English price-list.

PIGS PURCHASED RETURN SHEET

Telephone :
Telegraphic Address :

THE —— BACON CO., LTD.

Bought of

Pigs *Mark* *Received Slip No.*

No. 1 Scale. 6½ to 9 Sc.	No. 2 Scale. 9½ to 10½ Sc.	Over-weight.	Outside limits.	No. of pigs.	Scale.	Total weight.	Price per score.	£	s.	d.
					No. 2					
					No. 2					
					Overw't					
					Outside Limit					

Quality Book of Pigs Killed.

Date.	Bought from	No. of Pigs	Sizeable	Fat Sizeable	Stout	Fat Stout	Heavy	Fat Heavy	VI. Sides	Fat VI. Sides	Culls	Damaged	Sows	Weight.			Average Weight.			Average Price.			Cuts for Fat, Damages, etc.	Remarks.
														cwts.	qrs.	lbs.	cwts.	qrs.	lbs.	£	s.	d.		

The "Quality Book" of a bacon factory is by far the most important of any, and the various headings as given here should be filled with great care from day to day. On one side of the book the quality of the pigs handled is placed on record, and on the other side the selections and prices realised for bacon are given.

Selections and Prices realized for Bacon.

Salted.	Out of Salt.	Date sent out.	No. 1 Sizeable	No. 2 Sizeable	Medium Lean	Medium Stout	Heavy Lean	Heavy Stout	VI. Lean	VI. Fat	Sizeable Culls	Fat Culls	Unbranded	Order Bacon	Average Weight.			Average Price.			REMARKS
Date.	Date.														cwts.	qrs.	lbs.	£	s.	d.	

INVOICE

Telephone :
Telegraphic Address :

Date

Your Order No.

Our Order No.

Forwarded by

THE —— CO., LTD.

Per

Carriage

Sold to

Terms

CONSIGNMENT

		Cwt.	Qrs.	Lb.	Price.	£	*s.*	*d.*

CHARGE SHEET

Date

Telephone :
Telegraphic Address :

Their Order No.
Our Order No.
Forwarded by

THE —— —— CO., LTD.

Per
Carriage
Sold to

Terms

Entered in Day Book Folio					CONSIGNMENT	Cwts.	Qrs.	Lb.	Price.	£	s.	d.
DISSECTION												
Bacon . .												
Hams .												
Lard . .												
Sausages .												
Offal (*a*) .												
Offal (*b*) .												
Sundries .												
Total .												

PACKING ORDER

Date

Your Order No.

Our Order No.

Forwarded by

Per

Carriage

Sold to

THE —— BACON CO., LTD.

Consignment.		Weight.	
Bags Salt provisions.			
Barrels ,, .			
Kegs ,, .			
Boxes Sausages .			
Bales of bacon . .			
Parcels of bacon . .			
Total . .			

		Cwts.	Qrs.	Lbs.		Special Instructions.

Telephone No.

PUBLIC PIG MARKET

SALE NOTE

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2. —— ——

GENERAL LIVE-STOCK COMMISSION AGENTS

March 18, 1909.

Sold on account of Mr. ——,

Cork, *via* Liverpool.

CASH ADVANCED ON CONSIGNMENTS

All letters and telegrams to be addressed "——."

7 Pigs.					
	7 Gough.				
	£ s.		£	s.	*d.*
	14 0				
	10 18				
	11 0				
	10 11				
	11 2				
	10 7				
	11 2				
7 Pigs.	79 0 at 10s.		39	10	0
		£ s. *d.*			
	Cash on account . .	31 17 0			
	Commission for selling .	7 0			
	Expenses for driving .	7 0			
	Telegram . . .	9			
	Liverpool costs, tolls, &c. .	1 9			
	Due as on 19 March 1 .	2 0	32	15	6
	£ s. *d.*				
	7 0				
	7 0 Balance . . .		6	14	6
	9				
	1 9				
	2 0				
Freight 3s. 6*d.* each . . .	1 4 6				
	2 5 0 or 6s. 5*d.* per pig.				

Telephone No.

PUBLIC PIG MARKET

SALE NOTE

42 —— ——

General Live-stock Commission Agents

March 22, 1909.

Sold on account of Mr. ——,

Cork, *via* Liverpool.

Cash Advanced on Consignments

All letters and telegrams to be addressed "——."

		£	s.	d.
9 Pigs.	9			
	£ s.			
	11 9			
	10 18			
	10 14			
	11 2			
	11 7			
	11 6			
	10 19			
	11 9			
	11 14			
9 Pigs.	100 18 at 10*s.* 3*d.*, less 9*s.**	51	5	0
	£ *s.* *d.*			
	Cash on account . . 47 7 0			
	Commission . . . 9 0			
	Expenses . . . 9 0			
	Telegram . . . 9			
	Liverpool costs . . 2 3	48	8	0
	£ *s.* *d.*			
	9 0 Balance . .	2	17	0
	9 0			
	9			
	2 3			
Freight to Liverpool, 3*s.* 6*d.* each	1 11 6			
	2 12 6			
* Allowance	9 0			
	3 1 6 or 6*s.* 10*d.* per pig.			

THE —— ——, LIMITED

January 2, 1909.

PRICE-LIST (TYPICAL OF THOSE ISSUED BY BACON FACTORIES)

Terms: Net cash in seven days. All goods offered subject to being in stock and free on rail.

GREEN BACON: SIDES		SMOKED BACON: SIDES	
Lean sizable	60*s*. per cwt.	Lean sizable	65*s*. per cwt.
Sizable	59*s*. ,,	Sizable	64*s*. ,,
Medium	58*s*. ,,	Medium	63*s*. ,,

GREEN BACON: CUT

Lean sizable middles, Wiltshire	72*s*. per cwt.
Sizable ,,	71*s*. ,,
Medium ,,	70*s*. ,,
Dublin cut ,,	72*s*. ,,
Dublin cut ¾	64*s*. ,,
Gams	48*s*. ,,
Shoulders	48*s*. ,,
Gammons	60*s*. ,,
Hams, finest pale-dried	94*s*. ,,
Three-quarter Wiltshire sides	68*s*. ,,

SMOKED BACON: CUT

Lean sizable middles, Wiltshire	77*s*. per cwt.
Sizable ,,	76*s*. ,,
Medium ,,	75*s*. ,,
Dublin cut ,,	76*s*. ,,
Dublin cut ¾	68*s*. ,,
Shoulders	52*s*. ,,
Gammons	65*s*. ,,
Hams, finest	94*s*. ,,
Three-quarter Wiltshire sides	72*s*. ,,

Cooked gammons	70*s*. per cwt.
Sausages	6½*d*. per lb.
Black puddings	4*d*. ,,
White ,,	4*d*. ,,
Heads, branded	22*s*. per cwt., dry salt.
Smoked boned rolled shoulders	56*s*.
Luncheon sausage	6½*d*. per lb.

PURE LARD

In 28-lb. pyramid boxes, or pails	52*s*. per cwt.
In 1-lb. parchment packets	56*s*. ,,
In bladders	56*s*. ,,

ANOTHER TYPE OF PRICE-LIST

—— ——, Limited

Terms : Cash on receipt of monthly statement, less 2*d.* in the £

February 27, 1909.

The strong advance in the bacon market necessitates revision in our lean and sizable quotations, especially in the case of cut bacon, owing to the continued low value of ends.

Smoked Bacon : Branded

	Sides per cwt.	¾-sides per cwt.	Middles per cwt.	Gammonless per cwt.
Lean sizable	84*s.*	96*s.*	112*s.*	92*s.*
Sizable	80*s.*	90*s.*	104*s.*	87*s.*
Medium	68*s.*	75*s.*	82*s.*	72*s.*
Stout	66*s.*	72*s.*	78*s.*	68*s.*

White (or pale-dried) bacon prepared to order at same prices as smoked.

Bacon and hams specially prepared and packed for export and shipped to any part of the world.

Green Bacon : Branded

Lean sizable . 78*s.* .. Sizable . 74*s.* .. Medium . 62*s.*
Stout . 60*s.*

Smoked Bacon : Unbranded

Sides, sizable . 78*s.* per cwt. .. ¾ sides, sizable . 88*s.* per cwt.
,, medium . 66*s.* ,, .. ,, medium. 72*s.* ,,
Middles, sizable . . . 100*s.* per cwt.
,, medium . . . 78*s.* ,,

Backs, Gammons, Fores, Hams and Chaps

Backs :	
Lean	112*s.* per cwt.
Sizable	104*s.* ,,
Medium	90*s.* ,,
Stout	84*s.* ,,
Gammons	*66*s.* ,,
Fore-ends, sizable	*56*s.* ,,
,, stout	*54*s.* ,,
Chaps, branded	45*s.* ,,

Fore-ends rolled and boned, 4*s.* per cwt. higher ; shankless, 6*s.* per cwt. higher.

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* Fores, gammons, and unbranded bacon, being subject to frequent alterations in value, are charged at prices in force on day of despatch, whether higher or lower than these quotations, although no fresh circular may be issued.

ANOTHER PRICE-LIST—(*continued*)

Hams, long cut :

(Smoked or pale) 8 to 12 lb. . .	110*s*. per cwt.
,, ,, 12 to 14 lb. . .	108*s*. ,,
,, ,, 16 to 20 lb. . .	96*s*. ,,
,, Cumberland, 16 to 20 lb. . .	96*s*. ,,
,, Short cut, 8 to 12 lb. . .	86*s*. ,,

FINEST LARD: GUARANTEED PURE

Bladders

Under 30 bladders to 1¼ cwt. . . .	64*s*. per cwt.
30 to 50 ,, ,, . . .	66*s*. ,,
50 to 70 ,, ,, . . .	68*s*. ,,

Packets and Boxes. (Packages free)

½ lb. parchment packets, in 28-lb. boxes .	66*s*. per cwt.
*1 and 2 lb. parchment packets, in ½-cwt. boxes	66*s*. ,,
*7 and 14 lb. parchment packets, in ½-cwt. boxes	64*s*. ,,

PORK SAUSAGES

	net
Finest quality pork sausages . . .	7*s*. 6*d*. per doz. lb.
Ditto, tomato flavoured	7*s*. 6*d*. ,,

Carriage paid by passenger train on not less than 12 lb. Packages free.

German sausage (by goods train) . .	42*s*. per cwt.

(Not less than 14 lb.)

COOKED GOODS

	net
Cooked rolled and boned gammons .	1*s*. 1*d*. per lb.
,, ,, fore-ends . .	9*d*. ,,

Two sent packed in cardboard box, carriage paid by passenger train. Single gammons or fores, ½*d*. per lb. higher.

	net
Cooked chaps, small (average 1½ lb. each).	5*s*. 6*d*. per ½-doz. box.
,, ,, medium ,, 2 lb. ,, .	7*s*. per ½-doz. box.
,, ,, large ,, 2½ lb. ,, .	9*s*. ,,

N.B.: Customers are specially requested to name when ordering which size is required. If no size is named, "medium" will be sent.

* 1 and 7 lb. packets supplied in 28 lb. boxes.

BACON FACTORY AT CAPPOQUIN, IRELAND

As an example of the small type of bacon factory which has been found so suitable to the development of bacon-curing in the United Kingdom, we give here a description of the Cappoquin factory. Its structure and the equipment of the various departments, together with this technical description, will serve to explain the illustrations which we are also able to give.

"The town of Cappoquin is pleasantly situated on the Black Water, near Lismore, Waterford, Ireland. At one time it was a considerable centre of industry, but for more than a generation it has been simply a market town in which inconsiderable fairs are held week by week.

"Its ancient history is of interest, because it would appear that during the seventeenth century it was the centre of considerable stir in the warlike expeditions of 'The Great' Earl of Cork. Military operations in those days, however, do not appear to have been very imposing affairs, in spite of the solemnity with which we are informed that in 1642 a certain Lord Broghill, on his return from the relief of Knockmoane with about sixty horse and 140 foot soldiers, defeated a party of insurgents who were strongly posted in the vicinity of Cappoquin, and we learn that he accomplished this amazing military undertaking with the loss of only one man!

"The town owes much to the first Earl of Cork, as it was he who built the original bridge over the Black Water, now replaced by a fine stone structure. The valley of the Black Water from Cappoquin to Lismore and down to the mouth of the river at Youghal is one of the most beautiful in Ireland, and, unhappily, is very little known. From Youghal to Cappoquin the river is navigable for small vessels, a fact which may prove of considerable importance in the future development of the district.

"The late Sir Richard Keane, of Cappoquin House, endeavoured, by fostering local industries, to try and make Cappoquin an important centre, and, during his time, corn-mills and saw-mills were in operation. Since then, however, the trend of such businesses has been towards the sea coast, and, as a consequence, inland places like Cappoquin have been in a great manner deserted. It is due to the present occupant of Cappoquin House—Mr. R. H. Keane—that at least one industry has again been established in the old town."

The Breeding of Pigs. "It occurred to Mr. Keane that pig-breeding, properly conducted, should constitute a profitable department of modern agriculture. In his view it was not sufficiently developed in Ireland, and, bearing in mind the experience of such countries as Denmark, and the great prosperity which had come to them through the industry of pig-breeding, it seemed likely that a similar result might be hoped for in Ireland. As a consequence, the Home Farm at Cappoquin has, during the last three years, been chiefly occupied with the breeding of pigs, which are kept in large numbers, about one thousand being always in stock; this branch of farming being successfully carried on in conjunction

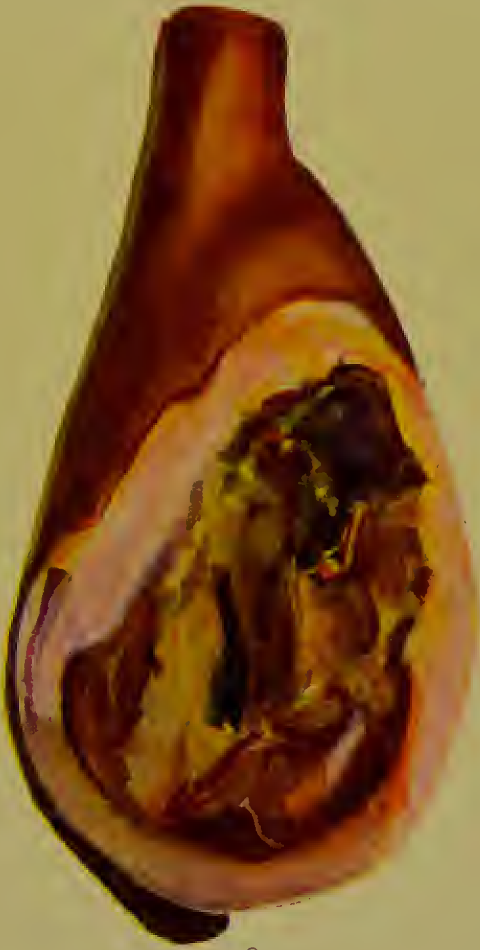
SMOKED IRISH HAM

8. Long-cut Ham, Smoked

A fine model of this world-renowned cut of ham, showing full proportion of appetising lean meat encased in well-balanced selvage of fat, of firm texture, small of bone; the fine smoke colouring is produced by a mixture of oak and elm sawdust.

9. The Same Ham

Cut diagonally above the knee-pan, showing the upper thigh-bone embedded in its plump covering of well-marbled white fatted flesh.



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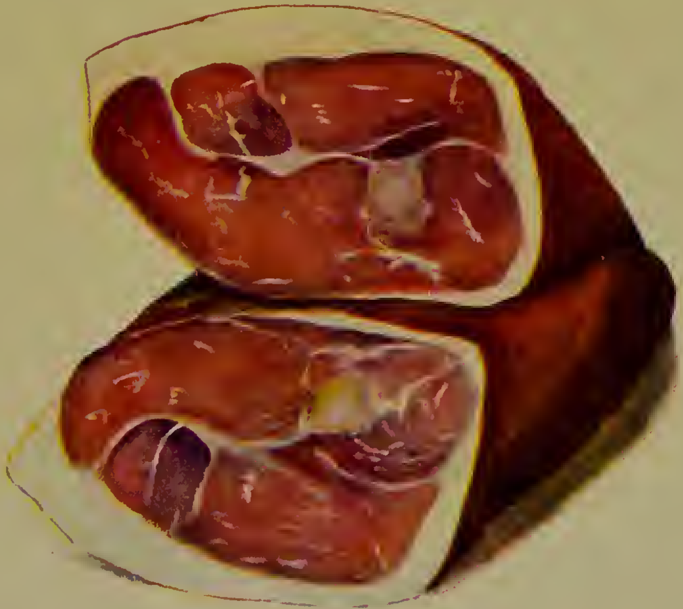

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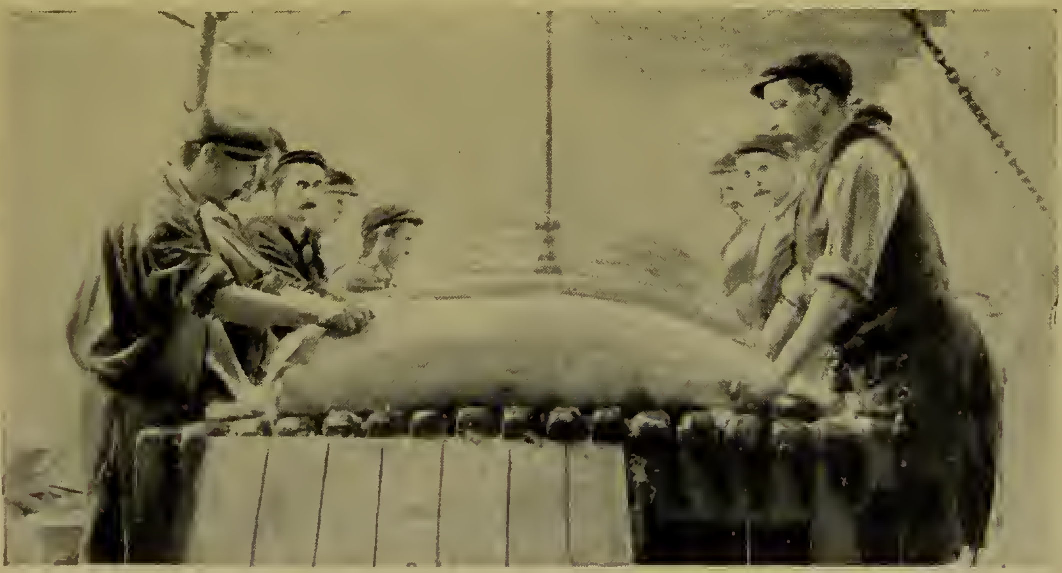
Cappoquin Bacon Factory: General View from the Blackwater River
Part of the town of Cappoquin is included in the picture.

with the cultivation of arable land, the breeding of sheep for mutton and extensive dairy-farming. The utilisation of the separated milk from the dairy-farm for pig-breeding is a leading feature, but not nearly sufficient is provided there, and, as a consequence, large quantities are brought to Cappoquin from Dungarvan and other centres in County Waterford.

"Pig-breeding and -feeding in Ireland have always been followed closely by the small farmers, but during recent years they have taken up a position of greater importance, and are now far removed from the category of casual occupations on the farm. Many private land-owners are directing their attention to this department of agriculture in the same way as has been done at Cappoquin, and there can be no doubt that the result will be of great economic value in the agricultural



At Work in Cappoquin Bacon Factory
The process of scraping the pigs on the scuttling-table, after scalding, is here illustrated.

development of the country, considering that the demand for pig products in the United Kingdom is steadily increasing."

Ireland's Export of Live Pigs. "For many years there has been a large export trade in live pigs from Ireland to Great Britain. In 1907 the number so exported totalled 481,907, or an average of about 10,000 per week. There is also at least a similar quantity exported in the shape of bacon, and when it is considered that the United Kingdom pays to foreign countries something like £20,000,000 sterling per annum for bacon and pig products, it will be seen that the supply of the Irish commodity is capable of being very much augmented. The principal countries from which bacon is imported into Great Britain are—Denmark, Canada, and the United States, and the latest agricultural returns from these countries show that there was, in 1907, a very considerable increase in the pig-supplies for that year—a fact which would lead us to suppose that British markets are being carefully studied by foreign breeders, and that the increasing demand for bacon warranted continued development in the pig-growing industry.

"These considerations convinced Mr. Keane that not only might pig-breeding be successfully carried on in Cappoquin, but that bacon-curing might also stand a chance of success. Accordingly he made up his mind to utilise the old Cappoquin saw-mill as a bacon factory, and in 1907 proceeded to have it transformed.

"The factory has now been working for a considerable period, and has been able to show a completely successful record since its start.

"The buildings are on two levels, the lower level (facing the Black Water) being devoted to pig-sties, abattoir, smoke-stoves, curing-cellars, boiler-house and machinery-room. On the higher level, which is nearly

Another View in Cappoquin Bacon Factory Singeing the Carcases

The singeing-furnace is an important appliance in preparing "Wiltshire" bacon. The pigs, after being scalded and partially scraped, are hoisted up through the singeing-furnace, head first. There they are burned for about a quarter of a minute, and then are withdrawn, when they present a very black appearance. They are then scraped and cleansed.

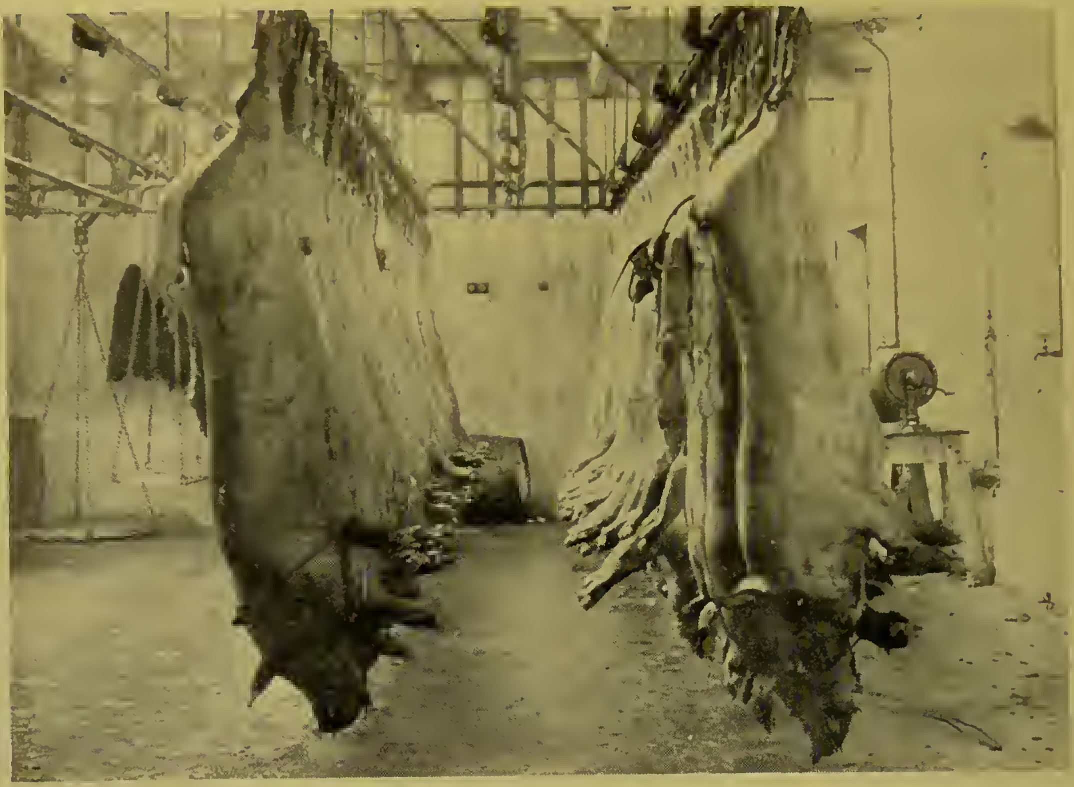
A Further Process in the Handling of the Carcases

After the pigs are scraped and cleansed they are disembowelled, and the offal is removed from the carcases.

on the level of the main street of Cappoquin, there are a hanging-house, chill-room, sausage-room, lard-room, and general offices. There is also a freezing-room which may be utilised for freezing butter, poultry, game, and other produce. The capacity of the factory is at present abcut five hundred hogs per week, and at least this number is being handled week by week, and has frequently been exceeded as opportunity arose for securing large supplies. These pigs, which form the raw material of this factory, are purchased, not only in the local markets, but a very considerable proportion of them are sent in direct from the farmers and landowners in the surrounding districts, who have been very loyal to the factory and given it all the support they could, since it started."

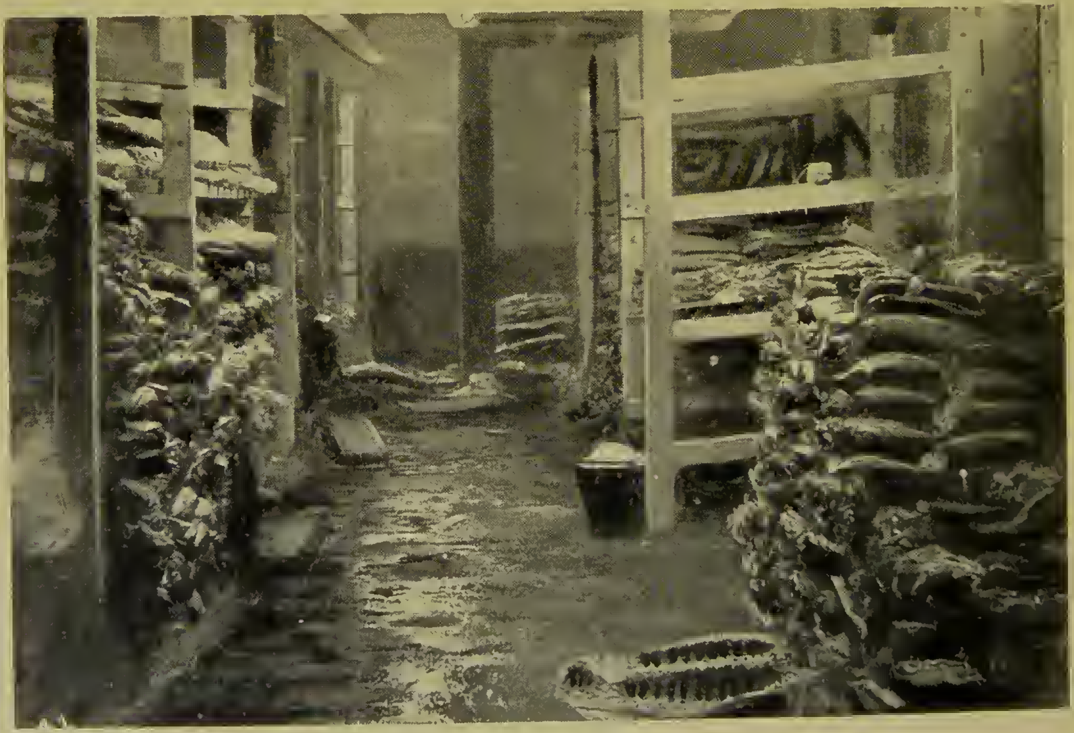
The Science of making Bacon. "The process of making bacon has, during the last twenty years, been reduced to a science, and the period of rule-of-thumb operations which existed before that time has now passed away. The consequence is that the 'cure' may now be reckoned upon with certainty, whereas previously, much depended upon the individuals engaged in the handling of the meats.

"At Cappoquin, the pigs are brought in at the lower level and may



In the Hanging-loft at Cappoquin Bacon Factory

After the carcases are disembowelled and cleansed they are hoisted to the hanging-loft, where, with head, feet, and flake-lard with kidney, they are allowed to cool, and the excess of animal heat is permitted to dissipate.

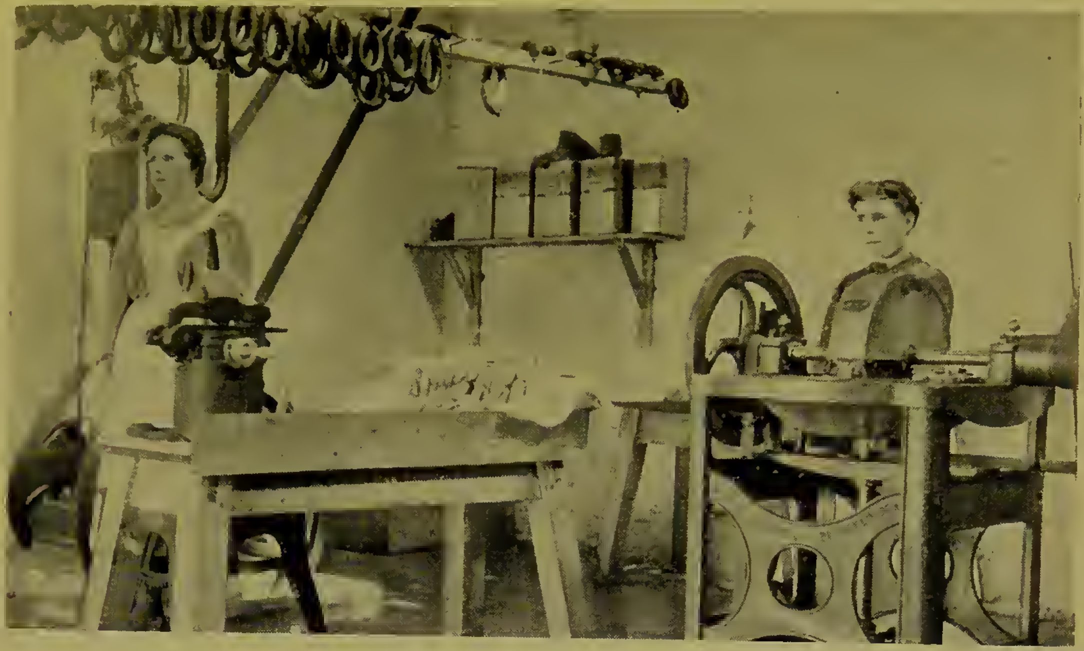


One of the Curing-cellars at Cappoquin Bacon Factory

Owing to the large trade that is done in hams and middles, racks have had to be erected for holding the meats during the process of curing.

also be landed from barges on the Black Water. They are paid for as delivered, and, after resting, pass through the abattoir, where they are killed and the offal and carcases separated. The offal is handled so as to make the most of it, and fortunately there is a very large demand for offal products in the vicinity.

"The carcases are scalded, and the greater portion of the hair removed on the scuttling-table. For singed-bacon purposes the carcases are then passed through a singeing-stack, where the remainder of the hair is removed by burning, and at the same time the rind is shrivelled by the heat, such shrivelling imparting a particular flavour to the meat. The subcutaneous fat is momentarily melted also, and this ultimately becomes very hard in texture and gives firmness to the sides.



Making Sausages at Cappoquin Bacon Factory

This view shows the sausage-room, where many of the fresh trimmings and other valuable portions of the carcases are converted into sausages, which are distributed all over the country.

"The Irish home trade in bacon is not for what are known as 'Wiltshire sides,' but for hams and middles; hence provision is also made for the production of these, and the singeing part of the process is omitted as not being necessary for this trade. The processes for scalding, removing the hair and the offal are identical, but from that point onwards they differ considerably.

"It is after the *scalding* in the case of 'hams and middles' pigs and after the *singeing* in the case of pigs intended for 'Wiltshire bacon' that the offal is removed. When the carcases have been cleansed, they are hoisted into a hanging-loft, where the excess of animal heat is allowed to escape and where, when partially cooled, the carcases are divided into sides. The *secondary* offal, consisting of the head, feet, and lard, is next removed, after which the sides are placed in the chill-room where, by the action of refrigerating machinery, they are reduced in temperature to about 38° Fahr. When this has been accomplished the sides are trimmed and are taken into the curing-cellars, where they are pumped with a recognised pickle of fixed composition, so that the curing material may come in contact with the tissues of the meat quickly. They are then laid down in stacks of ten sides, the one on top of the other, and as each one is so placed it is covered with an equal mixture of bacon-curing antiseptic and saltpetre, on the top of which a layer of fine salt is distributed. In this condition the sides are 'cured,' that is to say, the salt is melted by assimilation with the juices of the meat, and in this process a certain quantity of the liquid contents of the tissues is given up and runs away into receptacles provided for it in the cellar floors.

" Curing is mainly a process of decomposition, and it is not sufficient to merely impregnate the tissues of meat with a solution of salt to produce bacon. Certain putrefactive germs are always present in dead meat, and curing is a process of destruction which is partially successful in breaking down some of the tissues of the meat, irrespective of the presence of salt (which is not antiseptic to many of the germs), and in arresting the destruction of other tissues. Hence the flavour of the bacon produced, which is so different from that of fresh meat.

" The ordinary cure for 'Wiltshire sides' extends to about twelve or fourteen days, but the exigencies of trade often demand that this should be curtailed, and, as a consequence, bacon is frequently placed on the market which has only been in salt six or seven days. It is obvious, however, that the flavour of such meat cannot be so good as that which is kept for the full period. When the Wiltshire curing is completed, the bacon is washed, packed in bales of various sizes and sent away to the British markets ; or it may be smoked and similarly sent in the smoked condition. Where the carcases have been prepared as hams or middles and fore-ends, or other descriptions known in local trade, there are variations in the details of curing, as also in the treatment of heads, houghs, feet, and other secondary offal, which have to be cured and prepared for various markets, though the curing principles remain the same throughout.

" Two departments in a bacon factory which involve the exercise of much skill are those concerned with sausage-making and lard-rendering.

" The Cappoquin sausages have been sent to many parts of the country, as have also the minor products of black and white puddings, brawn, &c., and have earned for themselves a reputation as being of excellent quality. So also in the lard department much success has been achieved, and an extensive demand created.

" It goes without saying that the machinery and appliances in such a factory are of the very best possible kind. The principal requirements are a boiler and engine, along with powerful refrigerating machinery (which latter is applied so as to maintain the cellars at about 42° Fahr. and the chill-room at 38° Fahr.) and the various appliances used in sausage- and lard-making. There are many minor details which enter into the successful equipment of a modern bacon factory, the uses and necessity for which can only be learned by intimate acquaintance." *

Pork-packing in the United States. Considering the large part that the United States plays in supplying the world with pig products, the following statement is of more than passing interest:

PORK-PACKING IN THE UNITED STATES

Sixtieth Annual Report of the *Cincinnati Price Current* †

Statistics of the meat-packing industry of the United States under special investigations and compilations of the *Cincinnati Price Current* for the year ending March 1, 1909, with comparisons, are herewith presented. This is the sixtieth yearly statement of the kind.

The feature of a report separately for the summer and winter season exhibits has its explanation in the fact that prior to operations in the warm months under refrigeration facilities the annual records of pork-packing represented a long list of comparative exhibits for winter operations ending March 1. And in introducing exhibits for the operations subsequent to the cold months the records were made to conform to the intervening period, from March 1 to November 1, for the summer season. Continuation of such form of exhibits has been due to the desirability of maintaining comparisons with previous years—otherwise the calendar year construction of records for the continuous work would be appropriate. There is now practically no pork-packing by concerns not equipped for operating throughout the year.

For the twelve months now ended, the total slaughtering of hogs in the West has exceeded the preceding year, and any previous year, as to numbers, but the lighter average weight of the animals the past year has resulted in some reduction in aggregate weight in comparison with the preceding year. This feature appears to imply that the marketing of the animals has been, at an average age, younger than usual, and that they have been marketed with less of feeding of grain than ordinarily, incident to the high prices which have prevailed for corn. The gain in numbers slaughtered is over 3½ per cent., the decrease in weight over 3½ per cent., compared with the preceding year. The year has been attended with little of complaint of maladies among swine, so that losses have been comparatively light from such causes. The light weights have not favoured fulness of lard production, but when prices for this product are relatively high, as was the case the past winter, the natural shortage of lard-producing conditions is overcome to some extent in the inducement to trim more especially for lard.

For the eight months of the summer season of the past year, March 1 to November 1, the western commercial slaughtering, according to returns to the *Cincinnati Price Current*, represents a total of 17,456,000 hogs, making an increase of 651,000 in numbers, or nearly 4 per cent., in comparison with the corresponding period of the preceding year, and exceeding any earlier similar record. As compared with the annual average of five years previous to the past season, there was a gain of 2,665,000 in numbers, or 8 per cent.

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* *The Country Gentleman's Estate Book*, 1909.

† Reproduced from the *Cincinnati Price Current's Statistical Annual* for 1909. Compiled by Charles B. Murray.

For the four months of the winter season, November 1 to March 1, the total western commercial slaughtering represents 11,540,000 hogs, an increase of 365,000 in comparison with the preceding winter season, and an increase of 1,276,000 in comparison with the annual average for winter seasons for five years prior to the past season.

For the twelve months ending March 1, 1909, the western slaughtering represents a total of 28,996,000 hogs, compared with 27,980,000 for the preceding year, there being an increase of 1,016,000. There was an increase of 3,940,000 in comparison with the annual average for five years prior to the past year.

For the twelve months ending March 1 the total western production of green meats, lard and barrelled pork compares with the preceding year as follows:

	1908–9.	1907–8.
Green meats, lb.	3,420,070,000	3,550,336,000
Lard, lb.	866,187,000	909,634,000
,, tierces	2,624,000	2,756,000
Mess pork, barrels	45,000	80,000
Other pork ,,	406,000	374,000
Total pork ,,	451,000	454,000

The following is a summary of western slaughtering of hogs for the past two years:

Summer Season.	1908–9.	1907–8.
Number of hogs	17,456,000	16,805,000
Average weight, lb.	211.78	230.24
Yield of lard, lb.	30.20	32.89
Percentage yield of lard	14.26	14.28
Cost, 100 lb.	$5.87	$6.20
Winter Season.		
Number of hogs	11,540,000	11,175,000
Average weight, lb.	208.88	221.04
Yield of lard, lb.	29.37	31.92
Percentage yield of lard	14.06	14.44
Cost, 100 lb.	$5.87	$4.47
Twelve Months.		
Number of hogs	28,996,000	27,980,000
Average weight, lb.	210.58	226.58
Yield of lard, lb.	29.87	32.51
Percentage yield of lard	14.18	14.35
Cost, 100 lb.	$5.87	$5.52

The following table illustrates the progress in western slaughtering of hogs during the past thirty-two years, showing the numbers for years ending March 1.

1878	9,048,000	1894	11,605,000
1879	10,859,000	1895	16,004,000
1880	11,002,000	1896	15,010,000
1881	12,243,000	1897	16,929,000
1882	10,551,000	1898	20,201,000
1883	9,343,000	1899	23,652,000
1884	9,183,000	1900	22,201,000
1885	10,519,000	1901	23,601,000
1886	11,263,000	1902	25,411,000
1887	12,083,000	1903	20,605,000
1888	11,533,000	1904	22,375,000
1889	10,799,000	1905	23,918,000
1890	13,545,000	1906	25,575,000
1891	17,713,000	1907	25,430,000
1892	14,457,000	1908	27,980,000
1893	12,390,000	1909	28,996,000

For the five years previous to the period covered by the foregoing table the annual average was 6,560,000, which period extends back to the beginning of curing operations in the warm months through the introduction of refrigeration, the winter records previously representing the yearly numbers, which did not reach in any instance as many as 5,000,000 prior to 1872–73.

The amount paid out for hogs by western packers for twelve months ending March 1, 1909, was $358,507,000. For the preceding year the total was $350,353,000.

An illustration of the magnitude of the hog-slaughtering industry is obtained by the comparisons of cost of the hogs purchased by western packers, with also the approximate cost of eastern slaughtering, shown in the following, for years ending March 1:

	Western.	Eastern.	Total.
1908–9	$358,507,000	$79,000,000	$437,507,000
1907–8	350,353,000	77,000,000	427,353,000
1906–7	361,840,000	72,000,000	433,840,000
1905–6	302,487,000	65,000,000	367,487,000
1904–5	262,693,000	58,000,000	320,693,000
1903–4	282,365,000	63,000,000	345,365,000
1902–3	313,537,000	67,000,000	380,537,000
1901–2	323,346,000	65,000,000	388,346,000
1900–1	274,680,000	58,000,000	332,680,000
1899–1900	212,850,000	55,000,000	267,858,000
1898–9	203,696,000	50,000,000	253,696,000
1897–8	174,382,000	48,000,000	222,382,000
1896–7	135,456,000	42,000,000	177,456,000

	Western.	Eastern.	Total.
1895–6	142,268,000	48,000,000	190,268,000
1894–5	172,679,000	56,000,000	228,679,000
1893–4	166,090,000	64,000,000	230,090,000
1892–3	155,766,000	69,000,000	224,766,000
1891–2	141,698,000	58,000,000	199,698,000

These outlays are for hogs only, and do not include other features of cost incident to conversion of the animal into product, for labour, packages and other necessary expenditures.

The investigations and compilations in regard to stocks of provisions in the West on March 1, compared with last year, are summarised as follows, representing pounds :

	1909.	1908.
Sides, shoulders, &c.	354,000,000	387,000,000
Hams	218,000,000	205,000,000
Total meats	572,000,000	592,000,000
Pork, barrelled	28,000,000	26,000,000
Meats and pork	600,000,000	618,000,000
Lard	47,000,000	42,000,000
Total product	647,000,000	660,000,000

These tables indicate an increase of 13,000,000 lb. of hams, a decrease of 33,000,000 lb. of other cut meats, making a net decrease of 20,000,000 lb., there being an increase of 2,000,000 lb. of barrelled pork and an increase of 5,000,000 lb. of lard, compared with last year, in the stock on hand on March 1.

The stocks of hog product at the seaboard and other eastern cities and in transit on transportation lines, according to returns and estimates indicate the following comparisons for March 1 :

	1909.	1908.
Meats, all cuts, lb.	65,000,000	66,000,000
Barrelled pork, lb.	4,000,000	4,000,000
Lard, lb.	8,000,000	8,000,000

The eastern slaughtering of hogs the past year, ending March 1, compares with the preceding year as follows :

	Summer.	Winter.	Twelve months.
1908–9	3,702,000	2,499,000	6,201,000
1907–8	3,931,000	2,488,000	6,419,000

This comparison indicates a decrease of 218,000 hogs in the eastern slaughtering compared with the preceding year.

The production of green meats in the West and East for the year ending March 1, for two years, is indicated in the following, in pounds :

	Summer.	Winter.	Twelve months.
1908–9.			
West	2,070,000,000	1,350,000,000	3,420,000,000
East	370,000,000	250,000,000	620,000,000
Total, lb.	2,440,000,000	1,600,000,000	4,040,000,000
1907–8.			
West	2,167,000,000	1,383,000,000	3,550,000,000
East	400,000,000	250,000,000	650,000,000
Total, lb.	2,567,000,000	1,633,000,000	4,200,000,000

These figures make it appear that for twelve months ending March 1, 1909, the production of green meats West and East was decreased 127,000,000 lb. for the summer season, decreased 33,000,000 lb. for the winter months, and decreased 160,000,000 lb. for the entire year, in comparison with the preceding twelve months.

The exports of hog products from the United States for twelve months to March 1 compare with the preceding year as follows, in pounds :

	Meats.	Lard.
1908–9	574,000,000	526,000,000
1907–8	597,000,000	614,000,000

This comparison makes it appear that there was a decrease in exports of 23,000,000 lb. of meats and of 88,000,000 lb. of lard, in comparison with the preceding year.

The data of stocks of meats (including barrelled pork) at the beginning and ending of the year, with production and exports, make it appear that the domestic consumption for twelve months ending March 1 was approximately 3,485,000 000 lb., equal to about 40 lb. per capita.

The returns of barrelled pork made during the winter season show the following totals in comparison with previous years, representing number of barrels, for the West :

	Total mess.	All other.	All kinds.
1908–9	24,000	195,000	219,000
1907–8	56,000	139,000	195,000
1906–7	38,000	140,000	178,000
1905–6	31,000	143,000	174,000
1904–5	58,000	145,000	203,000
1903–4	77,825	135,180	213,005
1902–3	38,703	155,592	194,295
1901–2	72,970	143,660	216,630
1900–1	60,885	158,340	219,225
1899–1900	63,910	125,965	189,875

Barrelled pork made during eight months of the summer season, March 1 to November 1 :

	Total mess.	All other.	All kinds.
1908	21,000	211,000	232,000
1907	24,000	235,000	259,000
1906	12,000	220,000	232,000
1905	6,000	180,000	186,000
1904	15,000	142,000	157,000
1903	21,200	191,000	212,200
1902	4,800	174,300	179,100
1901	33,200	216,700	249,900
1900	14,300	188,600	202,900
1899	10,900	168,700	179,600

Total manufacture of barrelled pork in the West for twelve months ending March 1 :

	Mess.	Other.	Total.
1908–9	45,000	406,000	451,000
1907–8	80,000	374,000	454,000
1906–7	50,000	360,000	410,000
1905–6	37,000	323,000	360,000
1904–5	73,000	287,000	360,000
1903–4	99,000	326,200	425,200
1902–3	43,500	329,900	373,400
1901–2	106,200	360,300	466,500
1900–1	75,200	347,000	422,200
1899–1900	74,900	294,600	369,500

Western and Eastern Totals

Comparisons of total western and eastern slaughtering of hogs for twelve months ending March 1 in recent years are shown in the following :

	Western.	Eastern.	Total.
1908–9	28,996,000	6,201,000	35,197,000
1907–8	27,981,000	6,419,000	34,400,000
1906–7	25,430,000	5,548,050	30,978,000
1905–6	25,575,000	5,698,000	31,273,000
1904–5	23,918,000	5,773,000	29,691,000
1903–4	22,375,000	5,242,900	27,617,000
1902–3	20,605,000	4,641,000	25,246,000
1901–2	25,411,000	4,984,000	30,395,000
1900–1	23,600,000	5,380,000	28,980,000
1899–1900	22,201,000	5,971,000	28,172,000
1898–9	23,651,000	6,142,000	29,793,000
1897–8	20,201,000	5,933,000	26,134,000
1896–7	16,929,000	5,741,000	22,670,000
1895–6	15,010,000	5,470,000	20,480,000
1894–5	16,003,000	5,616,000	21,619,000

Comparative Stocks of Hog Product

The following is a comparison of stocks of hog product in the West at the beginning of the winter season, November 1, for two years:

West.	Nov. 1, 1908.	Nov. 1, 1907.
Meats, all cuts, lb.	273,000,000	315,000,000
Pork, barrelled, lb.	12,000,000	12,000,000
Meats and pork, lb.	285,000,000	327,000,000
Pork, barrels	62,000	63,000
Lard, tierces	107,000	92,000

Eastern stocks of hog product on November 1, with estimated quantity in transit on transportation lines, compare for two years as follows:

East.	Nov. 1, 1908.	Nov. 1, 1907.
Meats, all cuts, lb.	50,000,000	55,000,000
Pork, barrelled, lb.	2,000,000	4,000,000
Meats and pork, lb.	52,000,000	59,000,000
Pork, barrels	10,000	18,000
Lard, tierces	23,000	25,000

Total Stocks of Product, November 1

Approximate stocks of hog product in the country, West and East, on November 1:

	Pork, bls.	Meats, lb.	Total, lb.
1900	94,000	264,000,000	283,000,000
1901	99,000	280,000,000	299,000,000
1902	63,000	202,000,000	214,000,000
1903	58,000	268,000,000	279,000,000
1904	74,000	290,000,000	305,000,000
1905	81,000	295,000,000	311,000,000
1906	66,000	281,000,000	294,000,000
1907	81,000	370,000,000	386,000,000
1908	72,000	323,000,000	337,000,000

	Lard, tierces.	Lard, lb.	Total product, lb.
1900	73,000	24,000,000	307,000,000
1901	93,000	30,000,000	329,000,000
1902	48,000	16,000,000	230,000,000
1903	102,000	34,000,000	313,000,000
1904	88,000	29,000,000	334,000,000
1905	133,000	44,000,000	355,000,000
1906	199,000	66,000,000	360,000,000
1907	117,000	38,000,000	424,000,000
1908	130,000	43,000,000	380,000,000

Summer Weight and Lard

Average live weight of hogs and yield of lard, in pounds, summer seasons ending November 1:

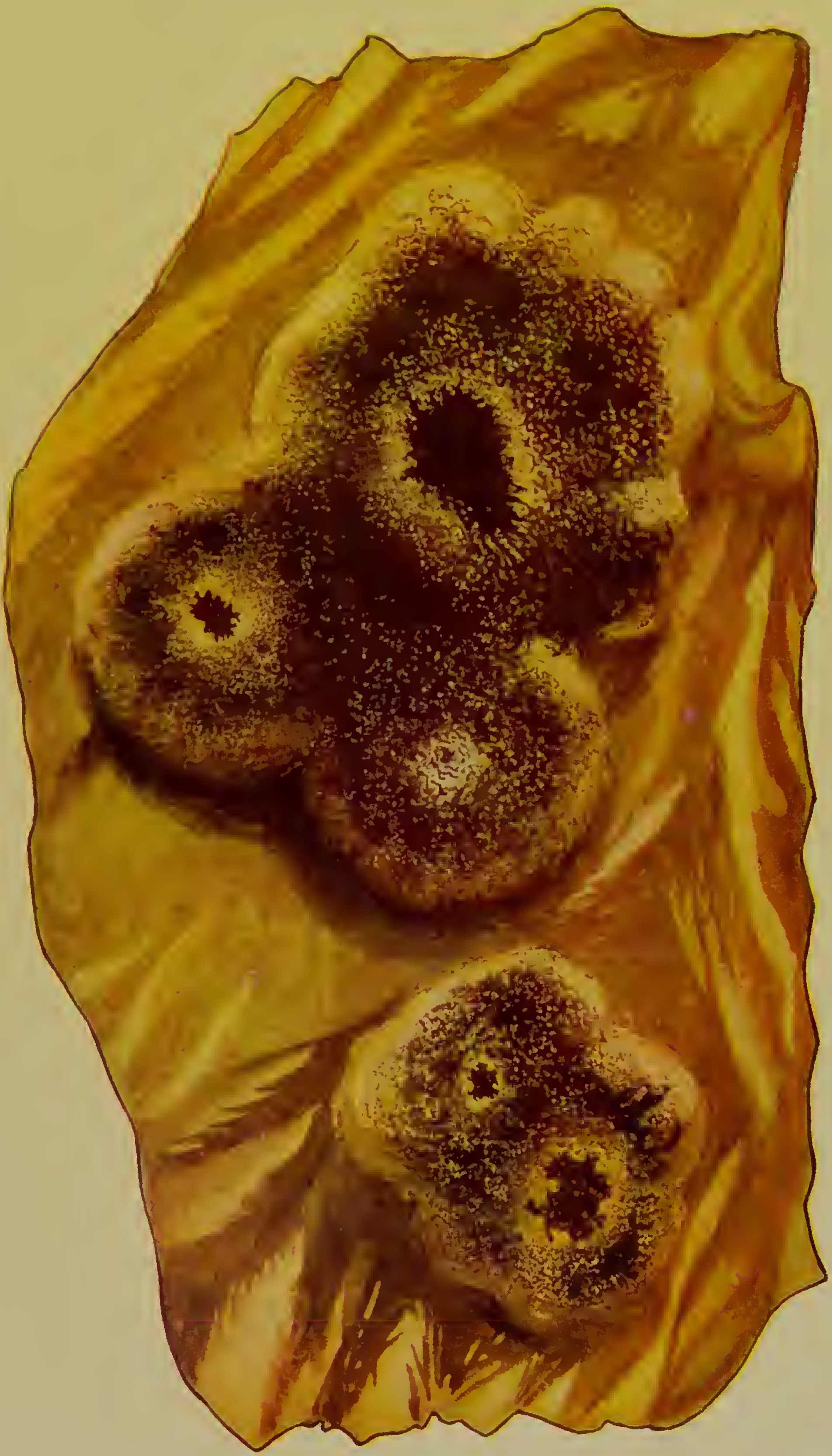
	Weight.	Lard.		Weight.	Lard.
1893	240.41	34.04	1901	219.48	31.81
1894	229.98	33.05	1902	223.11	31.34
1895	226.52	33.10	1903	231.03	32.58
1896	240.76	40.61	1904	222.09	32.39
1897	239.12	36.41	1905	221.72	33.25
1898	231.36	33.24	1906	223.14	32.18
1899	231.46	35.66	1907	230.24	32.89
1900	228.74	34.10	1908	211.78	30.20

Yearly Cost of Hogs

	Summer.	Winter.	Yearly.		Summer.	Winter.	Yearly.
1885–6	$3.90	$3.66	$3.75	1897–8	$3.70	$3.53	$3.63
1886–7	4.10	4.19	4.15	1898–9	3.85	3.52	3.71
1887–8	4.75	5.04	4.90	1899–1900	4.00	4.29	4.11
1888–9	5.58	4.99	5.26	1900–1	5.12	5.02	5.07
1889–90	4.30	3.66	3.98	1901–2	5.92	5.97	5.94
1890–1	3.91	3.54	3.74	1902–3	7.06	6.44	6.81
1891–2	4.48	3.91	4.16	1903–4	6.11	4.74	5.54
1892–3	5.03	6.54	5.60	1904–5	5.16	4.67	4.95
1893–4	6.33	5.26	5.87	1905–6	5.37	5.27	5.33
1894–5	4.98	4.28	4.67	1906–7	6.33	6.46	6.38
1895–6	4.41	3.68	4.07	1907–8	6.20	4.47	5.52
1896–7	3.30	3.30	3.30	1908–9	5.87	5.87	5.87

SWINE FEVER

Intestinal lesions, natural size. In this specimen the so-called " ulcers " are of the chronic type, having existed probably for some weeks, shown by the raised, thickened, firm edges, and central hollow. The lesions are not usually so large as in this case.



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CHAPTER VIII

DISEASES OF SWINE

THE diseases of pigs which have to be considered now, although, fortunately, not very numerous, still include one or two extremely important conditions, especially that of swine fever. This may justly be described as the curse of the pig-breeder. The conditions which we propose to note are swine erysipelas, swine fever, urticaria, swine plague, and the parasitic invasion which produces measly pork. Other conditions are dealt with in a later volume in connection with the subject of inspection.

Swine Erysipelas. This condition, which is due to a specific bacillus (*see* Bacteriology), takes its name from the rash which appears on the skin, which is of a reddish colour, suggesting a comparison to the human disease of the same name, with which, however, it has no pathological relations. As a rule, in this country, swine erysipelas is not a very serious disease, though occasionally there are specially virulent outbreaks. It rarely attacks pigs under three months of age, and the particularly highly bred pigs appear to be most susceptible, especially the light skin variety, in which, however, it must be remembered that the mild form with the cutaneous rash would be much more easily diagnosed than in the dark-skinned pigs. Continental descriptions of swine erysipelas give one the impression of a very much more formidable disease than that commonly seen in Great Britain, where, indeed, it cannot be said to be common at all.

A serious outbreak, however, occurred in Lincolnshire in July 1905, and was reported in the proceedings of the Board of Agriculture and Fisheries. According to this report the lesions were as follows: "The membrane of the stomach and intestines show red patches and are often swollen. The intestinal glands on the membrane are red and enlarged; sometimes the surface over these glands is abraded, but the distinct ulcer of swine fever is never seen. The lymphatic glands throughout the body are swollen and red. The spleen is often enlarged. The lungs are congested." A characteristic feature of swine erysipelas is seen in the animals during convalescence, when they exhibit lameness due to an inflammation of one or more joints.

Swine Erysipelas Abroad. On the continent of Europe immense losses of swine are periodically reported from this disease. Thus Ostertag states that not less than 62,568 pigs suffered from the disease in the Duchy of Baden between 1875 and 1884; this figure representing 1.8 per cent. of the total number of pigs in that district. Of those so affected, 7004 recovered; 15,512 died; and 40,052 were slaughtered for meat. Such figures as these show at once the frequency of the condition abroad as compared with this country.

Lesions found. In acute cases of the disease death occurs within a few hours, and in this the skin redness may not be obvious, but minute hæmorrhages are found subcutaneously, as well as in the substance of the muscle itself. In addition to this there are alterations in almost all the internal organs. The serous membranes exhibit numerous petechial hæmorrhages which are characteristic of most septicæmias. The mucous membranes of the stomach and intestines show considerable congestion but not actual ulceration, the spleen is enlarged from congestion, bluish red in colour and soft in consistence, suggesting somewhat the appearance found in anthrax ; but, of course, without the presence of anthrax bacilli. The liver may be congested and fatty, the kidneys are frequently similarly affected, as are also the lungs. Actual inflammation of the kidney is not uncommon. The muscles themselves are of a greyish red colour and are said to decompose rapidly. In the later stages the flesh is distinctly of a feverish type and would be condemned without hesitation. The heart, particularly in the forms which are subacute, is apt to show signs of valvular endocarditis (*see* Plate), with thickenings upon the valves frequently reaching the stage of large vegetations, especially on the left side of the heart. The condition of the lymphatic glands is that of swelling and œdema. The organism concerned is a small bacillus described elsewhere (*see* Bacteriology).

Judgment of Carcase. Swine erysipelas is a disease to which man is not liable, but all observers appear to agree that such carcases very readily decompose, as one would expect from the septicæmic nature of the condition ; moreover, as one would also expect, they set badly. So that in spite of the fact that the evidence of non-infection by eating the meat is quite conclusive the carcase should still be withheld from consumption. It is one more of those cases in which we shall repeatedly see that there is no danger of specific infection from the fresh meat, but that such carcases rapidly become unfit for food.

On the Continent, where inferior meat can be sold *under declaration*, it may be quite possible to deal with swine erysipelas in such a manner. In this country we have no such option. Ostertag recommends proceeding in this way where animals are slaughtered in an early stage of the disease, emphasising at the same time, however, the poor keeping qualities of meat from pigs in this condition, and further advising that such meat should only reach the consumer when cooked or sterilised. In Denmark, swine infected in this way are allowed to be consumed only within the infected district, the idea evidently being to prevent the possibility of the spread of the disease, while, at the same time, recognising that it is harmless to the consumer.

The continental view of this disease is that of Jensen, who is of opinion that erysipelas in swine is not a specific condition, but is due to *several* microbes and causes.

Swine Fever. This is by far the most important disease which the

SWINE FEVER

A typical lung from a case of swine fever with pneumonia. Note the consolidated and necrotic change (top right hand of picture), and the areas of congestion and patches of inflammation.

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pig-breeder in this part of the world has to contend with, and considerable attention must be paid to it both from the point of view of meat inspection and from that of the legal regulations concerning it. The disease is known in America as hog cholera, and it was introduced into that country in 1832. Though possessing points of resemblance to typhoid fever in human beings, swine fever is regarded as peculiar to pigs. It is a contagious, specific fever, caused by the bacillus of swine fever, which organism is described elsewhere (*see* Bacteriology). The disease occurs in two forms, the extremely acute, and the less acute or chronic form. In the former death takes place rapidly, especially in young animals, in about three days. In the latter, the disease may last as long as three weeks or even several months. It is far more common in young pigs than in older animals.

Lesions of Swine Fever. The most characteristic lesions are those of the alimentary tract, the skin, and the lungs, of which the first-named are certainly the most important. The degree of the changes which take place in these various situations depends upon the type of the case and the duration of the fever. The skin usually shows some discoloration in patches, some red, some purple, some black ; portions of the alimentary tract in rapidly fatal cases are seen to be congested, especially the stomach and the intestines ; in these situations there may be numerous petechial hæmorrhages.

Should the condition last long enough, the characteristic ulceration appears which is by far the most obvious pathological lesion in swine fever. It is depicted in various stages in our coloured illustrations. These ulcers vary in size from that of a threepenny-piece up to that of half a crown, the latter being a somewhat unusual size but occurring (as seen in the coloured Plate, which is drawn from a specimen and is the actual size). These ulcers are chiefly found in the large intestines, and in the neighbourhood of the ileo-cæcal valve ; they also occur, however, in the colon, the rectum, and small intestine, and even in the stomach. The process begins with the formation of a small nodule about the size of a pea, which shows all the evidence of an acute local congestion, spreading peripherally. As this advances there appears a central necrotic area which, after the sloughing of the superficial dead tissue, leaves, underneath, a raw ulcer. The margins of these ulcers, as can be well seen in the illustrations, are raised, thick and round, while the central portion and, to a certain extent, the peripheral part, is distinctly black in colour owing to the deposit of sulphide of iron ; a pigment which is commonly found in similar intestinal conditions.

Other lesions beside the typical ulcer are also associated with swine fever. There is to be found a diphtheritic inflammation accompanied by the production of a superficial false membrane, which may be seen upon the duodenum and ileum and which is depicted in one of the Plates.

This is composed of the products of a catarrhal inflammation of the mucous membranes, and therefore consists of dead epithelium and inflammatory products. The appearance represented in the coloured

Plate above referred to, in which this membrane extended over a large area, is somewhat unusual, but it is quite common to find it in isolated patches, and, indeed, the process is extremely similar to that which takes place in the early stages of the formation of the typical ulcer. In long-standing chronic cases healing of the ulcer takes place by scar formation and is very rarely followed by perforation, the ulcer usually penetrating no farther than the muscular coat of the intestine. On the peritoneal side, however, there is considerable thickening of the bowel owing to the proliferation of the connective-tissue elements. Somewhat less common situations for these necrotic and ulcerative changes are on the tongue, the pharynx, the. buccal mucous membrane, and in the stomach.

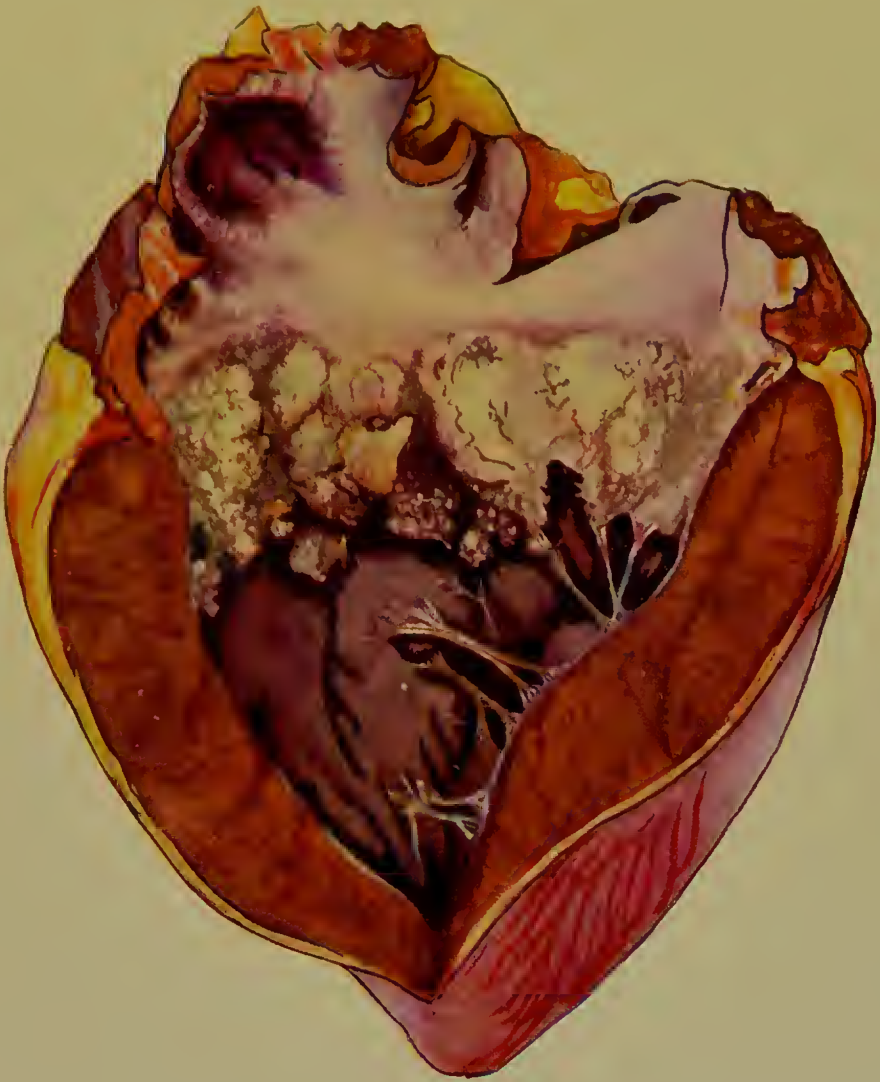
Other Lesions of Swine Fever. In a disease of such severity as this one would naturally expect to find evidences of its septicæmic nature throughout the body, and, as a matter of fact, this is the case. Thus we find numerous petechial hæmorrhages on the endocardium from degeneration of minute blood-vessels. The glands throughout the alimentary tract are swollen, œdematous and extremely congested, giving rise to the appearance sometimes described as strawberry glands. On section these glands may exhibit caseous portions which, however, do not become calcified.

The liver cells show the condition of cloudy swelling and, occasionally, also a number of necrotic patches. The kidney epithelium is also cloudy but, as a rule, the spleen is unaltered, though here, too, there is sometimes found evidence of necrosis.

The Lungs in Swine Fever. By far the most important lesion outside the alimentary tract is the pneumonia which is so frequently associated with swine fever and concerning which there has been, and is, considerable difference of opinion. The exact relationship of the inflammation of a portion of the lung to the swine fever specific condition is not perhaps thoroughly demonstrated ; but this much is certain, that pneumonia cannot be regarded as an essential part of swine fever for the very obvious and simple reason that the lungs *may be* perfectly unaffected. It is nevertheless true that in a large number of cases there is also present extensive inflammation of the lungs. A very usual appearance in such a case is represented in one of the Plates. This pneumonic condition exhibits very various forms, from slight inflammation of the lobular type to severe congestion with lobar pneumonia, and even necrosis. According to Professor Bang, of Copenhagen, these pneumonic changes in swine fever are produced by organisms other than that of swine fever itself and especially by the organism of swine *plague*, a germ which is found normally in the respiratory tract of pigs. Professor Bang has also shown that the bacillus of necrosis has been found in cases of swine fever of the more chronic type, and it would appear that these organisms act in co-operation in producing the various necrotic results which follow upon the croupous inflammation of swine fever, including those of the lungs. So that the complications of the lungs in this disease on these grounds are to be looked

SWINE ERYSIPELAS

A typical case of "verrucose" ulcerative, or vegetative, endocarditis.



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upon as additional changes from special infections and not as an essential part of swine fever.

Judgment of Meat. Despite the fact that swine fever itself is not infective to man, the meat inspector is absolved from any responsibility in connection with the flesh of animals which he has found to be suffering from this condition, since the Swine Fever Order makes it illegal to use the flesh for food and requires the carcase to be destroyed. The only time when the discretion of the inspector is required is when an animal is slaughtered on account of *suspicion* of the presence of swine fever, which on dissection is found to be *absent.* In such cases the inspector must use his discretion and common sense, forming his own opinion according to what he finds.

Swine Plague. This infectious disease of pigs, which is recognised by American writers under this name and is well known to German pathologists as *Schweineseuche,* does not appear to be met with in very definite form in this country, or if it is, it is not usually described as such. We therefore follow Ostertag's description of the condition.

The disease is produced by a microbe described by Löffler and Schutz as similar to that found in cattle septicæmia, rabbit septicæmia, fowl cholera, and the septicæmia of wild game, though the organisms in each case are probably specific.

Lesions in Swine Plague. The typical and characteristic lesion of swine plague is a pneumonia of a necrotic type. There may be discoloured patches upon the skin as in other septicæmic conditions, together with an œdematous condition of the subcutaneous tissue. Along with the pneumonia there is frequently pericarditis, and, as in all pneumonias which are of any great extent, there is pleurisy. Indeed, pleurisy and pericarditis may be the only lesions to be discovered on post-mortem examination. Peritonitis may be also present. The liver, kidney, heart muscle, and other muscles undergo cloudy swelling in the acute stage of the disease, and as one would expect there is general enlargement of lymphatic glands. The thorax shows the presence of numerous adhesions in connection with the pleura and the pericardium, together with multiple necrotic areas in the lungs.

Ostertag states that in the acute stage swine plague may be mistaken for swine erysipelas, since in both there may be a reddening of the skin ; but in acute swine plague the red coloration is of a lighter shade and restricted to the under parts of the body. Moreover, in swine plague there is no enlargement of the spleen, no inflammation of the intestines, nor hæmorrhagic nephritis. Should the characteristic lesion in the lungs be present there is no difficulty. In doubtful cases the diagnosis must depend upon a bacteriological examination, or by inoculation of guinea-pigs, which die in one to three days from swine plague inoculation, but which are immune to that of swine erysipelas.

With regard to the judgment of the meat inspector in the presence of swine plague we quote the following paragraph from Ostertag :

Judgment. " Fiedler and Bleisch are of the opinion that the meat of hogs affected with swine plague should be considered as injurious to health. They state: 'We should not fail to mention that as long as the immunity of man toward the bacteria of swine plague has not been demonstrated, the pathogenic action shown in our experiments of the bacteria of swine plague toward different animal genera creates a fear of such action toward man. Especial care in the practice of meat inspection appears to be required with regard to this matter.' Against this view is arrayed the experience of meat inspection. Quite aside from the fact that the pathogenic action of the micro-organism in experimental animals proves nothing with regard to man, before the discovery of the specific nature of swine plague, the meat of animals affected with the pectoral and intestinal form of the disease was always admitted to the market for the reason that the disease was considered as a simple pulmonary inflammation as a result of colds. Nothing, however, is known concerning injury to human health from eating such meat. To be sure, Pouchet and Zschokke reported observations, according to which the meat of hogs affected with swine plague is said to have exercised harmful effects. These observations, however, are not unexceptionable. In the case reported by Pouchet, the pork was in a state of decomposition, while the case of Zschokke is not clearly explained, and, as the author himself states, was perhaps to be considered as a case of poisoning from saltpetre. Prettner made inoculation experiments on mice with swine plague by rubbing infectious exudations from a hog into skin wounds. The result was negative. Furthermore, an infection of man from handling the altered organs of animals affected with swine plague has never occurred.

"If, in spite of these facts, all scruples against the admission of the meat to the market cannot be overcome, at any rate no objection can be raised against the sale of the meat when well boiled or sterilised, since we know that the bacteria of swine plague in pieces of meat which are not too thick are destroyed by exposure for one hour to a temperature of 80° Cent. In this way, also, the requirements of the veterinary police are satisfied.

"Such a procedure, however, is necessary only in the case of acute swine plague, since in this form bacteria are present in the blood and even in the meat.

"The meat of hogs affected with swine plague is to be excluded from the market as highly unfit for food, when icterus is associated with an acute stage of specific inflammation of the pulmonary and the costal pleuræ; or when the animals are greatly emaciated in consequence of the disease."

Urticaria. This disease, commonly called nettle-rash, which occurs principally in the pig, is characterised by the presence in the skin of peculiar patches of a hæmorrhagic nature, frequently rectangular in shape. These patches, sometimes described as diamond-shaped, have an irregular distribution all over the body. The condition is dark red at first, becoming paler later on from the surface downwards.

The cause of urticaria is somewhat disputed. Loremy has described bacilli that occur in coloured patches, and Jensen demonstrated that

THE LUNG IN SWINE PLAGUE, OR CONTAGIOUS PNEUMONIA OF SWINE

The condition here depicted is that of a lung from a case of swine plague or contagious pneumonia of swine (*German*, Schweineseuche, *Holland*, Pestpneumonie). The usual form of the disease is that of a pneumonia with multiple areas necrosing, as here seen. The pneumonia which occurs in Swine Fever in Great Britain is in all probability of this nature, and is depicted in another plate for comparison. This illustration is reproduced here by kind permission of Dr. J. Poels, of Rotterdam, from his work "De Varkensziekten in Nederland."

some cases described as this condition were really of the nature of swine erysipelas, while Dr. Melvin states that urticaria in hogs " is merely a localised affection of the skin in which a bacterial invasion plays no part. The urticaria symptoms may result from various causes; thermic influences on the skin, irritants, certain drugs, and gastro-intestinal disorders may produce the characteristic rash of urticaria. In most of the cases in hogs it is brought about by a gastro-intestinal catarrh, with the subsequent action of the absorbed fermenting toxins upon the walls of the blood-vessels. The condition may be classified as a mild inflammatory exudative process, in which the pathogenesis is identical with that of any other inflammation. It is produced by a direct influence of the cause on the wall of the vessel and not, therefore, the influence of the central nervous system as has been formerly supposed."

Apparently the meat of swine suffering from urticaria is not condemned in any districts where this disease occurs, but the inflammatory patches are excised. There is no doubt, however, that the carcase must be considered as inferior in quality, and individual judgment must be relied upon in various cases.

Trichinosis in Swine. This disease, which occupies so much of the attention of continental meat inspectors, is seldom heard of in connection with British swine, but, as is the case with some other diseases which are seldom looked for here, it is just possible that cases occur which are not recognised.

It is due to a small nematode worm, the *Trichina spiralis*, the larval stages of which are passed in the muscles and the presence of which

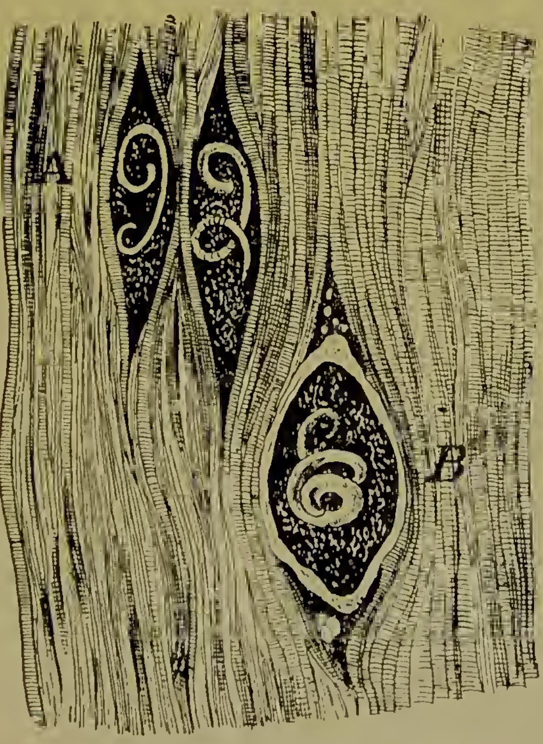


Fig. 1.—Trichinosis in Swine.

A. Spiral larvæ in muscle. Early.
B. Later changes. The encysted larva.

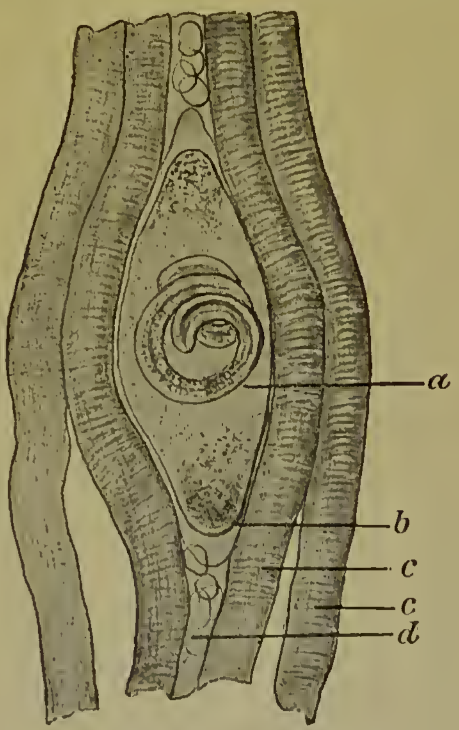


Fig. 2.—Trichinosis

a. Spiral larva. *b*. Cyst wall.
c c. Muscle fibres. *d*. Fat globules.

constitute the condition. The worm itself lives in the intestines. In America from 1 to 3 per cent. of swine are supposed to be infected. Its life-history has been fully worked out experimentally by feeding swine on infected meat, when the earliest larvæ appear in the muscles of the fed animal in about seven or eight days, but chiefly between a fortnight and twenty days. The complete growth takes three weeks. After that the larva takes on the spiral form represented in the illustrations (Figs. 1 and 2). The muscle then degenerates in the immediate neighbourhood, losing its transverse striation, and subsequently a capsule is formed round the larva. Calcification of this capsule often occurs later. It is an error to suppose that trichinæ are found in muscle only, as they have been demonstrated in the lungs, thymus, and lymphatic glands.

The distribution is very irregular in muscles, and it is well recognised that the special regions affected are the muscular part of the diaphragm, the laryngeal and tongue muscles, the intercostal muscles, and some abdominal muscles. Accordingly it is from these sites that the inspector takes the muscle to be examined (*see* Vol. III.).

The pig is the only food animal in this country subject to infection, but the dog is also liable and is a food animal in some lands. The fact that trichinæ are transmissible to man, in whom they set up a serious condition, gives an important aspect to this parasitic infection. The human source is, of course, the eating of infected pork in which the larvæ are alive. The pig in its turn has been infected from some other animal, often the rat, in which animal trichinosis is very common.

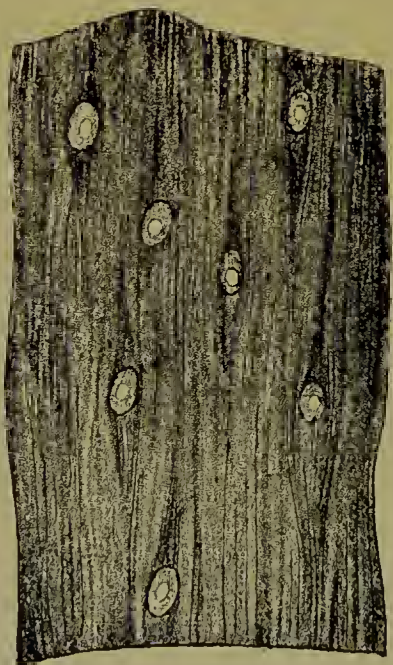


FIG. 3.—TRICHINOSIS

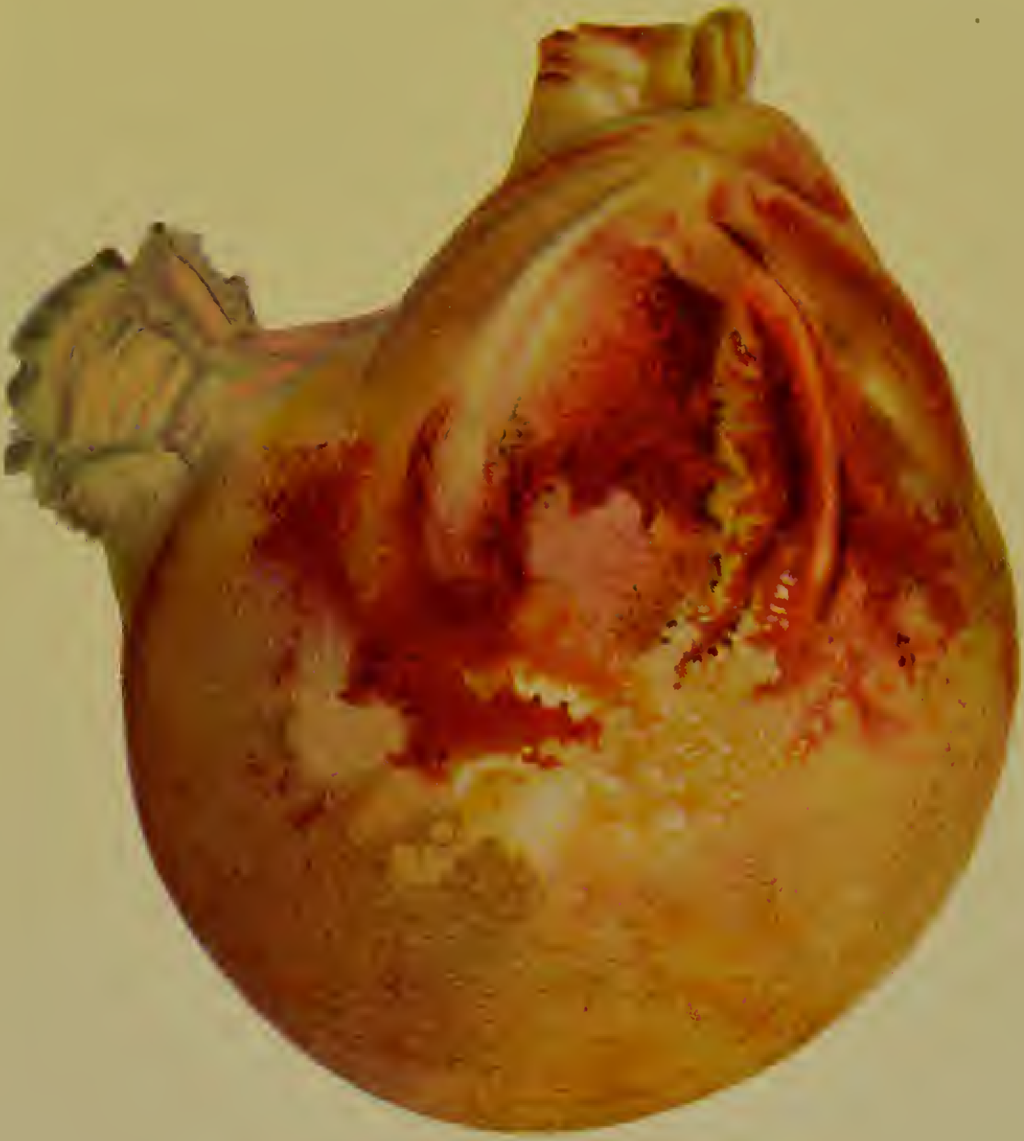
Measly pork, showing trichina cysts in muscle.

In a badly infected case in the pig astonishing numbers of the larvæ are found, Leuckart estimating 1500 per gramme of muscle to be a common number. It has been calculated that the total number in a badly infected pig may be as great as 158,400,000.

Diagnosis. The microscope, or at least a magnifying lens, is the only reliable means of ascertaining with certainty the presence of the parasite, and in countries where the disease is common there are special arrangements at the abattoir for this investigation (*see* Vol. III.). A good inspector's lens which magnifies forty times is adequate. With such a glass the encysted parasite can be seen as an oval or rounded mass containing the coiled parasite. The appearances of infected flesh are shown in the illustration (Fig. 3).

SWINE FEVER

The stomach of a case of swine fever of the croupous or diphtheritic type, showing hæmorrhages and congested areas. Reproduced by kind permission of Dr. J. Poels, Rotterdam, from his work "De Varkensziekten in Nederland."



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CHAPTER IX

FISH AND FISH MARKETS: THE FOOD SPECIES

We have now to turn our attention to the study of that section of the national meat industry which concerns itself with fish, a section which is of very great importance on account both of its immensity from a commercial aspect and on account of the dietetic importance of the food itself.

It would be rather difficult to say exactly what species should and should not be included in any list of the edible fish in this country, since the British fish markets are now supplied from an area of sea over distances of many miles from our own coasts, and consequently produce in various seasons an immense variety of fish which is used for food. As a matter of fact, the fisheries of the British Islands, if we take as our standard those which are included in the statistical returns of the industry, extend from such widely separated points as the North of Ireland and the Bay of Biscay and also from the Porcupine and Rockall Banks of the Atlantic practically to the Danish and Holland coasts. Fish are nowadays brought to this country from anywhere within these wide limits, and this has, of course, been made possible chiefly by the substitution of the modern steam trawler for the old fishing-smack. It is chiefly during the last twenty-five or thirty years that the great increase has been made, as the result of which vessels engaged in the fishing business go so far afield in search of their cargoes, but it is not only the introduction of steam vessels which has been responsible for the great extension of the fisheries; there have also been along with that a corresponding improvement and advance in the gear used for fishing, and by means of which the fishermen are now able to do their work at far greater depths of water than used to be possible.

Before the period spoken of, it was usually assumed that a depth of seventy fathoms was a limit to practical fishing. To-day steam trawlers fish at depths of a hundred and twenty fathoms with great results.

Progress of the Fishing Industry. Some idea of the progress made in the fishing industry in recent times may be gathered from the fact that the amount of fish landed in Great Britain has reached the enormous quantity of no less than 750,000 tons per annum. That quantity, of course, represents considerably more than can be regarded as strictly the product of our own fishing-grounds, but it is probably true to say that it is all financed by British capital. But this is by no means all, for, in addition, there is something like 50,000 tons per annum landed in Ireland. The annual value of this immense quantity of fish may be estimated at £6,000,000 for England, £2,000,000 for Scotland, and £350,000 for Ireland.

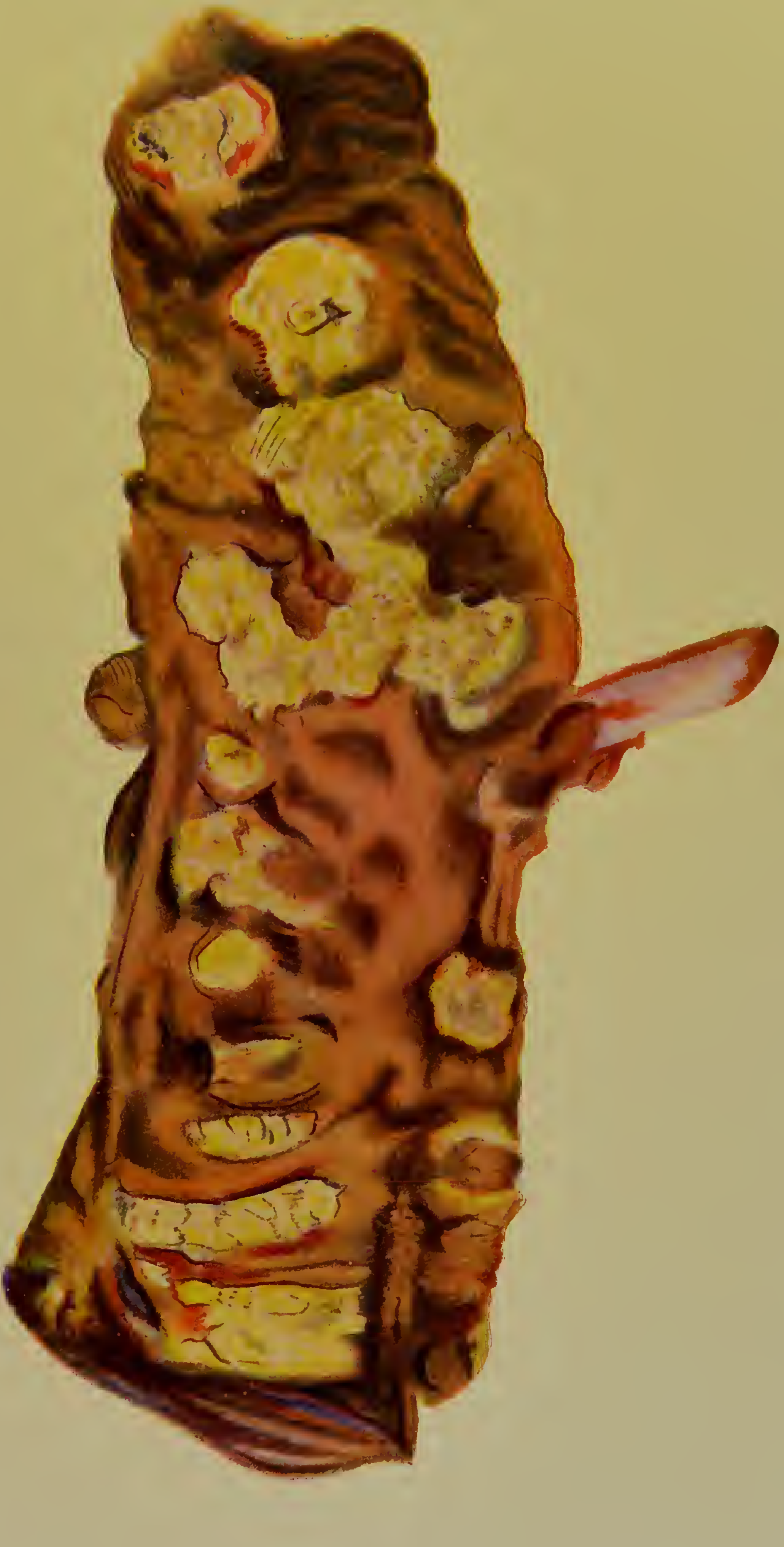
This immense result is, of course, due to our insular position, which gives us advantages in the fishing industry possessed by no other European country. Thus, to take only one example, our herring fishing alone extends from the North of Scotland as far south as Yarmouth, and we have available great distances of trawling-ground in the North Sea which are so situated as to be readily worked. Fortunately, in spite of the tremendous quantities of numbers of fish which are represented by the figures above quoted, the supply seems to be inexhaustible ; at any rate there is no fear of its giving out, provided only that the fisheries be even fairly treated. This is because of the extraordinary reproductive power of the fish themselves ; the herring has been estimated to produce from 20,000 to 30,000 eggs, while cod and turbot and some other fish produce millions. In no other way, indeed, can an industry, such as the Scottish herring-fishing, handle one thousand million fish every year, as it is said to do, most of which are taken and dealt with either by importing for inland consumption or packing for export trade on our north-east coasts.

The method adopted in connection with the export of herrings will be found in detail when we come to deal with that particular fish.

The Fish Trade in Great Britain. The production and distribution of fish differ in many respects from the production and distribution of meat. The most important distinction is that between the farmer's all-important share in raising the best stock and the fisherman's passive attitude towards the harvest of the sea which he and his kind reap without sowing. The efforts so far made to restock the sea—confined mainly to the culture of lobsters in Norway and the transplanting of shad in America—are, if not wholly negligible, interesting rather as not unsuccessful experiments, but before anything of the kind can be attempted on the scale which alone would make it a factor in the future of the fisheries, an almost inconceivable revulsion in public opinion would be necessary in order to ensure that financial support from the State, without which all such enterprise must be too restricted to count. In any comparison, therefore, between the statistics of men and boys employed in the fisheries and those of agricultural labour throughout the country, it should not be overlooked that the whole of the eighty thousand men and boys returned for the fishing fleets of Great Britain (and not including Ireland) are engaged in catching fish, in producing it, that is to say, in the economic sense and not as the farmer produces the stock on his farm. The annual landings of fish at our ports, fish caught, almost without exception, by British boats, are enormous and fairly constant, and the marvel is that the sea can continue to honour such extravagant draughts on its account as a year's returns (1907) of upwards of 22,000,000 cwt., excluding shell-fish, and of a value (including shell-fish, which are only given in the official returns in value) exceeding £11,000,000. This, it will be seen, brings the average value of the fish (excluding shell-fish) to about one penny per pound. Before, however, arraigning the "honest

SWINE FEVER

A portion of the intestine from a case of swine fever, showing the ulcerative and necrotic processes in various stages. Reproduced by kind permission of Dr. Poels, Rotterdam, from his work " De Varkensziekten in Nederland."



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fishmonger" as the recipient of untold profits, we must remember that these official prices are those obtained at Billingsgate and similar great markets, and that the smaller fishmonger has to buy from a middleman or through an agent and to bear the cost of railway carriage, the rent and other expenses of his shop, and the considerable losses incurred by the sale of such perishable goods. In fact, like consumers of mustard, those who buy fish have to pay for much that is not used. Buying fish from a retail dealer is, however, a very different matter from buying it at Billingsgate, where a number of customs, and even a few tricks of the trade, are observed which would not obtain at the small fishmonger's. On the other hand, the small fishmonger, and particularly the street hawker, may practise petty deceptions that would be beneath the dignity of salesmen in a great market. It would be a counsel of perfection to caution the public against buying fish in the streets of inland cities. Cheapness and expediency will always foster a demand for provisions brought to the back door. At the seaside, indeed, such street-sold fish often comes straight out of the boats and may be fresher than much of that sold at the large shops, which is supplied by rail from Billingsgate; but in the great centres inland, it is too often bruised and tainted fish that these hawkers offer to their customers. The buyers in that great market are so experienced, for the most part, that they know both the customs and the tricks by heart and suffer little loss or inconvenience from either. A novice, however, might easily be at a loss to understand the procedure in any of these fish markets, and it is to him that these remarks are addressed.

How the Subject will be treated. In order to cover the ground contemplated here, it has been thought most expedient to divide the subject under the following heads:

I. What are the food fish?
II. How to distinguish them.
III. When they are in season.
IV. How they are brought to market.
V. How they are bought.

The first two sections are of obvious importance. Not all the two hundred and more fishes in British seas are fit for the table, and not more than one in every ten are ever seen on it. That there are others which could be utilised is undeniable, but fashion rules these matters, and many excellent fish which the amateur knows to be most palatable are ignored, in some cases because the professional fishermen do not catch them in sufficient quantities to supply the market. The proper way to tell each fish is another clearly important piece of knowledge, and it is necessary, since to err is human, to recognise not merely the whole fish, a comparatively easy job, but also to know a portion of it, lest a slice of an inferior kind should be palmed off on the unsuspecting purchaser for something better. The bringing of fish to market embraces both production (or their capture) and distribution, by rail or other means, and it is chiefly on the latter that the remarks under Section IV. will fall. The remaining factor in their distribution, their sale in the markets and shops, is, from the standpoint of this handbook, the most important of all, seeing that it includes not merely the art of the buyer in getting the best value for his money, but also the work of the inspector in safeguarding the public against the dangers incurred by the consumption of fish that is no longer fresh.

I. WHAT ARE THE FOOD FISH ?

Theoretically, any fish which is wholesome food comes under this head, as we should not, classifying food fish on such a basis, even take into account the fancies of the epicure or even the approval of the average palate. The little gobies and rocklings, fishes familiar only to the naturalist in his rambles along the shore at low tide, would be on the same footing as the sole and turbot ; and the wrasses, the pollack, the coal-fish and the sea-breams would all have to be considered, seeing that the last-named are excellent eating, while the rest are all edible, and two of them are even largely consumed in the poorer quarters of large towns. Yet to include the gobies, suckers, and rocklings in a list of food fish,* however admissible from the academic standpoint, is, commercially speaking, a mistake.

As an example of a fish which should really take high place among food fish, but which is practically neglected in this country, we have the bass. At Constantinople, the bass, which grows in Turkish waters to nearly double the size of our own average fish, but which is otherwise identical, is esteemed, with red mullet, the finest food in the market and sells readily at a shilling a pound. It is eaten either plain boiled or in a mayonnaise, and the larger examples of from ten to fifteen pounds, regarded in this country as uneatable, are there the most sought after. It is very rarely that a large bass is seen at the fishmonger's in this country, and, indeed, it is only in our coast towns that these fish are commonly offered for sale at all, and then only the smaller sizes taken in the shore seines. The reason for the bass being in so little request in this country is to be found in the readiness with which the public is educated in its tastes by those with an interest in guiding them. Large bass are difficult to catch. They must be taken with hook and line and in special places, and it is only in the East that the fishermen have the necessary patience. The fact of a fish keeping badly and rapidly deteriorating may also have much to do with its absence from inland markets. The pollack, for instance, which is nearly related to the Scottish saithe, or coal-fish, is taken in large quantities by the line-fishermen in Cornwall, but as it packs badly, and as, moreover, it would not pay the long journey by rail, it is all sold in the villages of the duchy by itinerant hawkers known as " jowders." Another fish much neglected on British tables is the ray, or skate. The dish called *raie au beurre* is frequently seen in the menu of the best French restaurants, though much of its success depends on the magic of the cook. Prepared carelessly, ray is a coarse-eating fish, and the strong flavour of its flesh, which possesses stimulating qualities, would disgust sensitive palates. Again, we neglect practically the whole of our fresh-water fish. In Germany and other continental countries, perch, pike, carp, and some other "coarse fish" are of the greatest importance, particularly in great cities remote from the coast. In the best hotels of cities like Berlin and Dijon, the visitor is served with these fish admirably cooked. The comparatively short distance between our own inland centres and the seaports will always prevent any general demand for such fish in the United Kingdom, but it is curious that no caterer should have been enterprising enough to try the experiment.

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* Professor McIntosh and Mr. Masterman include the gobies in their admirable work on the "Life History of British Marine Fishes," and Mr. Cunningham finds a place for the other two in his "Marketable Marine Fishes," while the former book ignores the skate, a fish of enormous commercial importance, and the latter dismisses it in a few lines.

Of sea fish mostly consumed in the locality of their capture, the chief are the coal-fish (*Gadus virens*) and cat-fish (*Anarrhicas lupus*) of Scotch waters, the pollack (*Gadus pollachius*) and pilchard (*Clupea pilchardus*) * of Cornwall, and the conger (*Conger vulgaris*), dog-fish (*Scyllium catulus, &c.*) and weever (*Trachinus draco*) of Sussex. A fish which is reckoned edible in one part of the country may be in no demand in other districts, as witness the Scottish prejudice against eels, and the similar objection entertained in some markets against garfish, on account of the green colour of the bones.

Thus, although it will be necessary to refer incidentally to some others, mostly related to those in the following list, only twenty-five fish can be described as generally marketable, and to these must be added the shell-fish, including the crustaceans (*i.e.*, lobster, crab, prawn, and shrimp) and the molluscs (oyster, mussel, cockle, winkle, &c.). The list of twenty-five kinds which it is proposed to consider in order is as follows:

Fish

	Family		*Family*
Salmon	*Salmonidæ.*		
Smelt		Mackerel	*Scomberidæ.*
Cod	*Gadidæ.*	Dory	*Cyttidæ.*
Haddock			
Whiting		Garfish	*Scombresocidæ.*
Hake			
Ling		Gurnards	*Cottidæ.*
Herring	*Clupeidæ.*		
Sprat		Bass	*Percidæ.*
Shad			
Sole	*Pleuronectidæ.*	Grey mullet	*Mugilidæ.*
Plaice		Red mullet	*Mullidæ.*
Flounder			
Turbot		Eel	*Murænidæ.*
Brill		Skate	*Raiidæ.*
Halibut			

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* The bulk of Cornish pilchards are cured for export to the Mediterranean.

Shell-fish

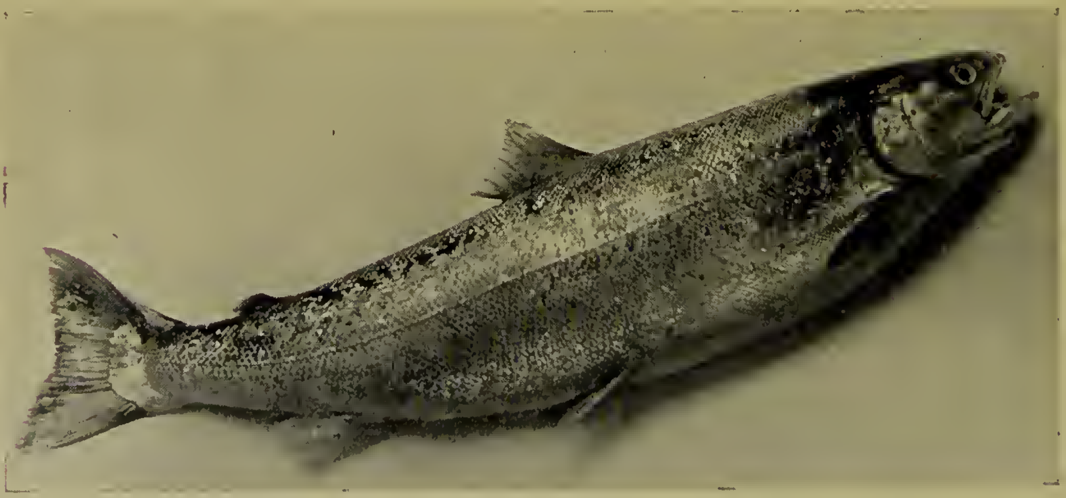
Lobster Crab Prawn Shrimp	Crustaceans.	Oyster Cockle Mussel Whelk Winkle	Molluscs.

It might have been more convenient for ready reference to arrange these in alphabetic order, but that course would involve unavoidable confusion. The arrangement according to biological affinities is preferable, because the fish of a family are not only caught in much the same way, but are classed together in the trade. Thus, the herring and its kind (as well as the mackerel) are oily fish. The cod and its four cousins, together with the sole and other flat fish, are less oily. These, with the gurnards and skate, are supplied chiefly by the trawlers ; the herring, pilchard, and mackerel are caught in drift-nets or seines ; the salmon and grey mullet in seines ; the red mullet in trammels ; the crabs and lobsters in traps known as " pots " ; the eels in baskets ; the shrimps and prawns in either hand-nets or small trawls.

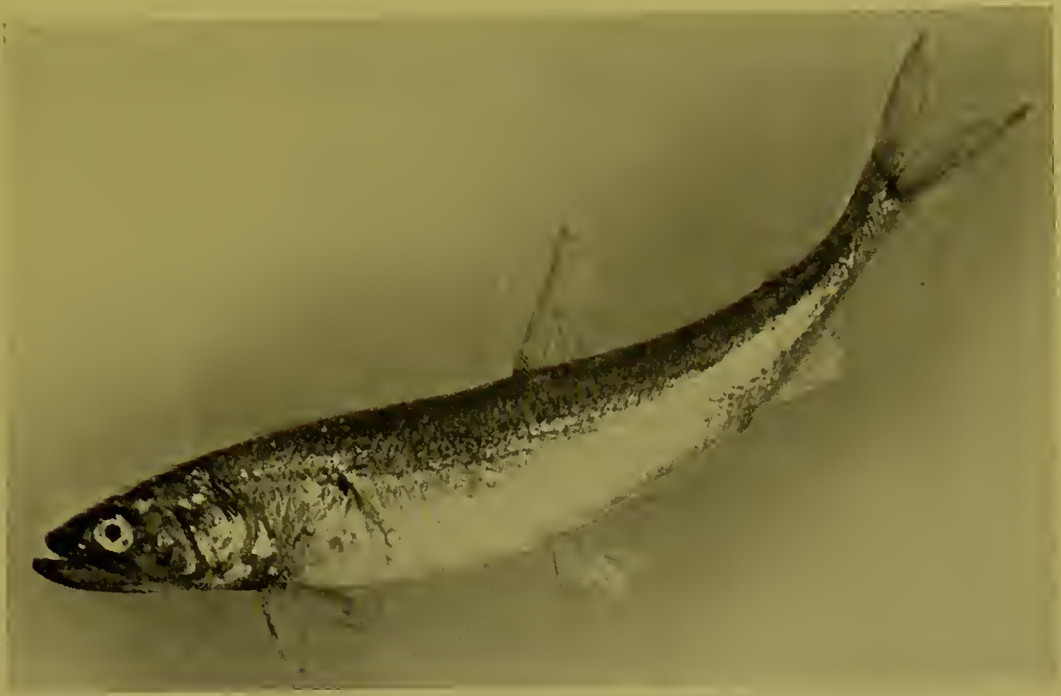
The next important matter is how to tell one fish from another. This would be simple enough in the case of some extraordinary looking fishes which are not, however, commonly seen in the markets and which, like the giraffe or hippopotamus among beasts, resemble no other living creature but themselves. Thus, the chimera, the sun-fish, the sword-fish, and the sea-horse could not possibly be mistaken for any other kind.

II. HOW TO DISTINGUISH THEM

Salmon (*Salmo salar*). Too well known to need lengthy description. A silvery fish with x-shaped spots and with a small rayless and fatty fin (known as the " adipose " fin) on the back, just in front of the tail. In old salmon the lower jaw is hooked. " Kelts," which are salmon



Salmon Trout



SMELT

exhausted after spawning, are miserable-looking fish, unfit for food. They should never be bought, not only for this reason, but because it is unlawful even to have them in possession.* The flesh of the salmon is pink, the depth of colour varying not only according to condition, but also according to locality of capture. Salmon have been recorded as heavy as 80 lb. The very latest work on the life-history of the salmon is from the pen of Mr. Malloch, manager of the Tay Salmon Fishery. It is a wonderful summary of the latest research.

Smelt (*Osmerus eperlanus*). A little semi-transparent fish, having in common with the salmon, at first sight, only the adipose fin, by which it can always be distinguished from the atherine, or so-called sand-smelt (*Atherina presbyter*), an inferior kind sometimes sold for the finer fish. The smelt rarely exceeds ½ lb. in weight.

Cod (*Gadus morrhua*). A familiar fish, brown or greenish grey above and white on the belly. It has a small fleshy "beard" under its chin and a well-marked white line along the sides known as the "lateral line." Cod grow to a length of 4 or 5 ft. and a weight of 50 or 60 lb. The best come from the North Sea, and there is also a great fishery off Newfoundland.

Haddock (*Gadus æglefinus*) has also a small "beard," and the lateral line is black. It is a much smaller fish, the heaviest on record being

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* Various Salmon Acts fix the close season between September 3 and February 1 (both inclusive), and every river fixes its own close time for both nets and rods, but the close time must last not less than 168 days in Scotland and Ireland, or 154 days in England and Wales, for the nets, and not less than ninety-two days in England and Wales for rod-fishing. Char are protected, and may not lawfully be bought or sold between October 2 and February 1 (both inclusive), and coarse fish (barbel, pike, perch, &c.) from March 15 to June 15, both inclusive.

Cod

Cod

Whiting

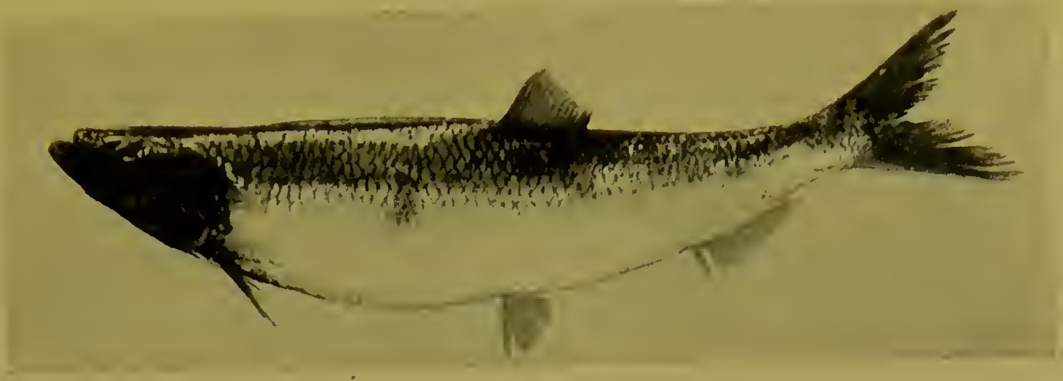
24 lb., and the average market fish less than 5 lb. It is most plentiful in colder seas, particularly on the east coast of Scotland. It has a black blotch on the sides of the body, which the fishermen associate with the thumb and finger marks of Peter, though the fish regarded by the Syrians of Galilee as that which yielded the tribute money is a cat-fish.

Whiting (*Gadus merlangus*). This smaller and still commoner fish, which grows to a length of only 24 in. and a weight of 4 or 5 lb., has no "beard." The teeth are small and needle-like and very numerous. It is sometimes called the "silver" whiting, but the silver soon rubs off after capture.

Hake (*Merluccius vulgaris*), which grows to a weight of at least 20 lb., is a coarse-scaled member of the cod family, a surface-dwelling fish which chases the pilchards and herrings. Its pursuit of the shoals of smaller prey may account for its curious "periodicity," as it has been called. Instead of being regularly migratory, like the herring, pilchard, or mackerel, appearing and disappearing at fixed seasons of the year, the hake puts in a sudden appearance, after, perhaps, years of absence, and vanishes as unexpectedly, without apparent cause. This makes the line-fishery in home waters very uncertain, and most of the hake are now caught in the trawl. It is a coarse fish, but in great demand in the poorer districts. It has only two fins on the back ; the cod has three.

Ling (*Molva vulgaris*). This is the largest of the cod family and has been recorded up to 7 ft. long and 124 lb. in weight. It is a widely distributed fish, being plentiful both in Scottish waters and in the English Channel. It is a long eel-shaped fish, with a "beard."

[The **Pollack** (*Gadus pollachius*) and **Coal-fish** (*G. virens*) are also large members of the same family, the former a southern form, though also straying to the north, and the latter chiefly plentiful in Scottish waters. They are not, however, sent to the London or other great markets, though they find a ready sale at low prices near the coast. The **Torsk** or **Tusk** (*Brosmius brosme*) is a member of the cod family, which grows to a weight of 40 lb. and is chiefly caught round Shetland. It is confined to Scottish waters and not found in the English Channel. It is dull yellow in colour and smooth to the touch. The flesh is firm and white, good



HERRING

eating, but in little demand and never seen in the better class of fishmongers' shops.]

Herring (*Clupea harengus*). This is the type of, perhaps, the most important fish in the sea. The migrations of herrings give employment to immense Scottish fleets, which follow them right round the coasts of Britain and even pursue them to the south-west of Ireland. It is a very familiar fish, silver on the body and, after death, suffused with red on the head. (Note that a similar appearance of red in the head of the mackerel is a sign of decay setting in.) The average size of herrings depends on the sea they are caught in. Being a cold-water fish, the herring is at its best in the north, and whereas a fish of 12 in. is the average in the English Channel, herrings of Scotch seas average 16 or 17 in. when full grown. There are, however, many different races, one on the famous Ballantrae spawning-banks being of very large size, while the herrings of Stornaway are small and fat. The herring is a delicate fish, dying immediately after capture.

The manners of curing herring for home or foreign markets are referred to later.

Sprat (*Clupea sprattus*). This is a smaller fish. It can be distinguished from a herring of the same size by the jagged edge of its belly, the absence of teeth in its mouth and the position of the back fin, which starts from a point nearer to the tail than in the herring. Sprats are made into "sardines" at Deal and Folkestone. They are also smoked on a large scale, and for these there is always a demand.

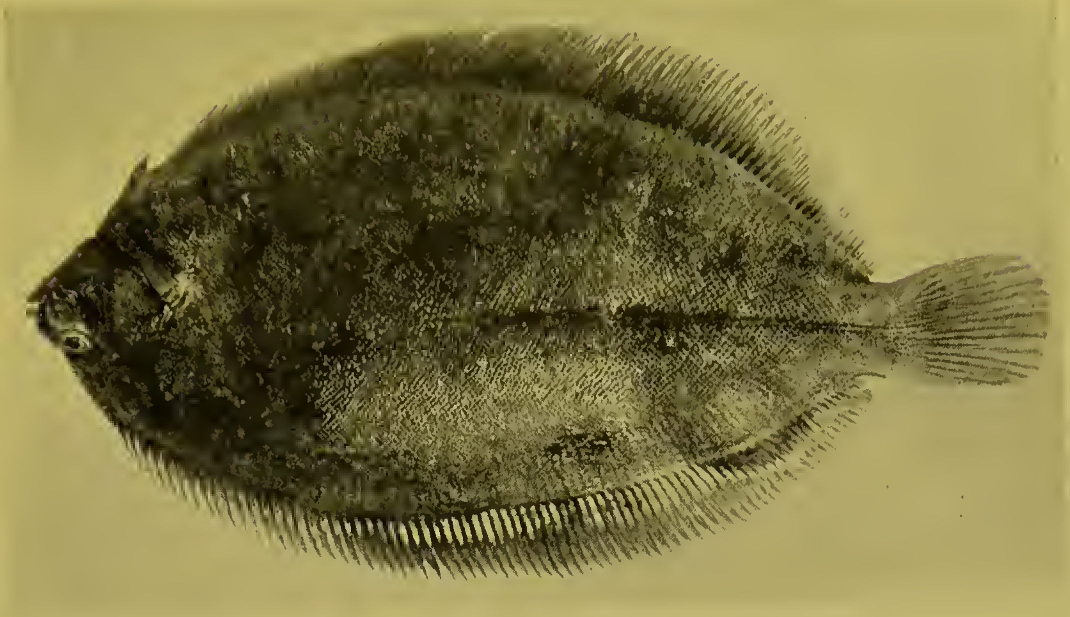
Shad (*Clupea alosa* and *C. finta*). The allis and twaite shad are two fish of the herring family, which, like the salmon, enter some of our rivers to spawn. The allis grows to a weight of 8 lb., but the twaite does not commonly exceed 2 lb. They are green and silver, with spots on the sides and a dark mark on the shoulder.

[The **pilchard** (*Clupea pilchardus*) is an important fish in Cornwall, but figures little in the home markets. There is a "sardine" factory at Mevagissey, where the pilchards, which are the same fish as the French "sardine," are tinned in oil; but the chief industry is that of salting them in barrels, each of two or three thousand fish, for export to Spain and Italy, chiefly for use during Lent.]

Sole (*Solea vulgaris*). A familiar, though increasingly scarce, flat fish of elongated shape and dark brown colour above. The under side is white. The eyes are very small, and the face has a peculiarly wry twist, more accentuated than in any other flat fish. The female is slightly larger than the male in all the flat fish, and the largest on record measured 26 in., which is, however, far above the average. The sole becomes mature, *i.e.*, able to deposit spawn, at about 10 or 11 in., and it would greatly benefit the species if all soles under the smaller of these measurements were protected by law. Some of the finest quality of soles used to be caught off Dover and elsewhere close to our coasts, but the depletion of home grounds has made it necessary for the trawlers to seek them farther and farther away. Street hawkers occasionally succeed in palming off skinned weever as sole, but the flesh of the weever is much coarser and the deception should easily be detected.

PILCHARDS

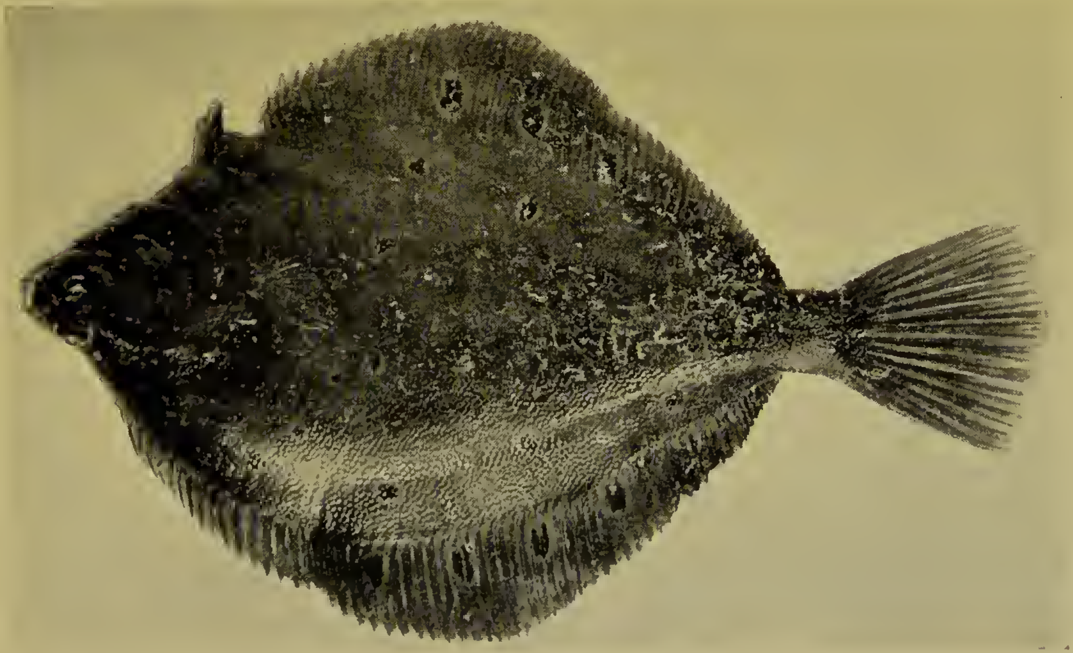
The **Lemon Sole** (*Pleuronectes microcephalus*) is a very different-looking fish, rounder in shape and more like the plaice. It is vastly inferior



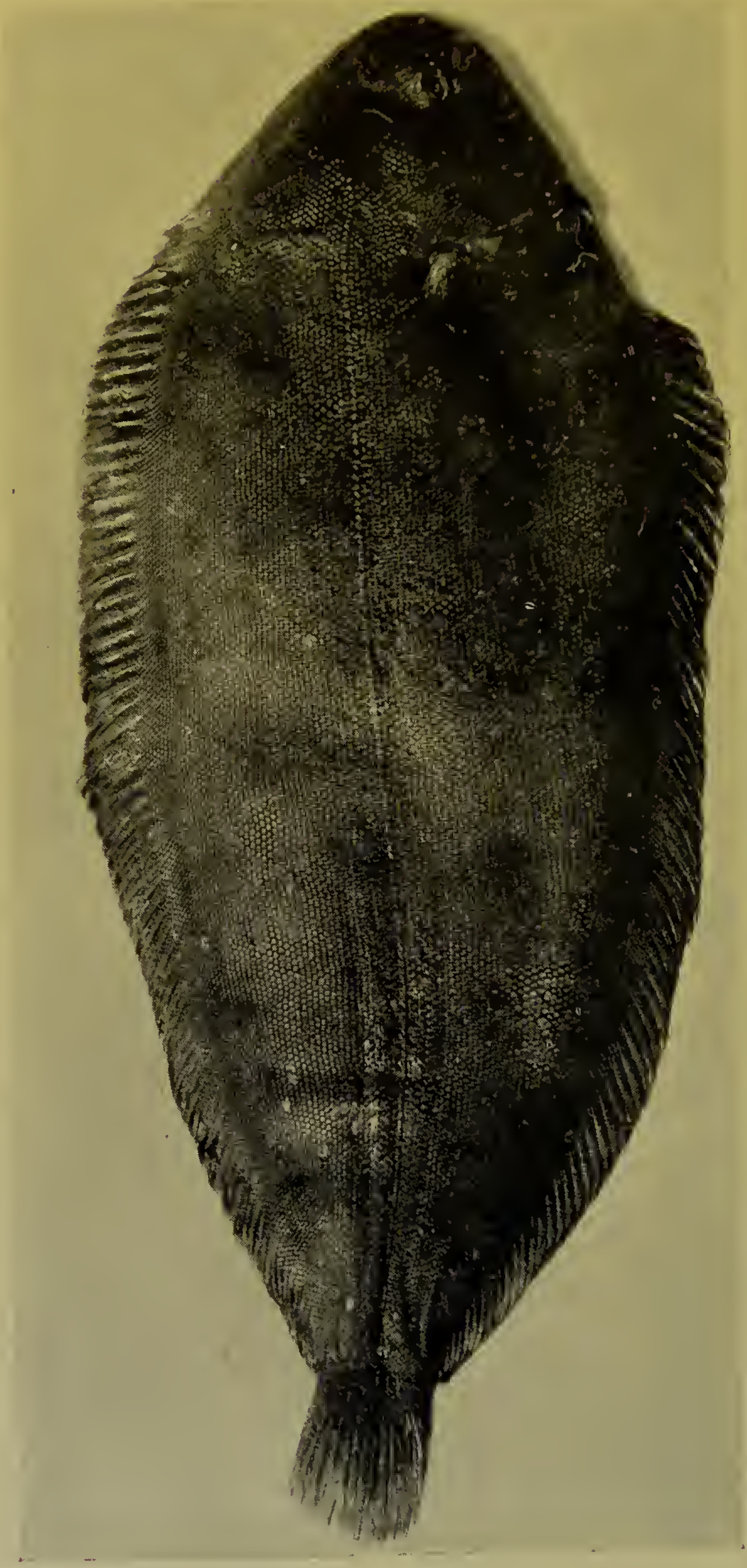
Lemon Sole

in flavour to the sole proper, and there should be no possibility of confusion, but the habit of some first-class hotels in putting it down on the menu as sole renders a passing word of caution necessary.]

Plaice (*Pleuronectes platessa*). This broad flat fish is easily recognised by the red spots on its back, the ground-colour of which is dark brown. The under side is white. It is smooth to the touch, as the scales are small and sunk deep in the skin. There is, however, a sharp spine in front of the ventral fin, at the side of the head. The largest example on record measured 33 in. and weighed 15 lb., but nothing of this size need be



Plaice



Dover Sole

Turbot

looked for nowadays. Indeed, the greatest length of the average Scottish plaice is 28 in. (Cunningham); in the Plymouth district, 24 in.; in the west of Ireland, 26 in.—from which it will be seen that this fish, like the herring, varies considerably. The plaice is mature in the English Channel at 15 in. (Cunningham) and in the North Sea at 17 in. (Holt). It spawns early in the year, and the roe is not agreeable eating.

[The **Dab** (*Pleuronectes limanda*) is a smaller fish, the largest on record being 15 in. It is mature at 4 or 5 in., so may be caught much smaller without injuring the stock. It is light brown with dark spots, much rougher to handle than the plaice, and with the same sharp spine in front of the fin. Both plaice and dabs are very hardy out of water, retaining their life almost as long as eels, like which they are able to keep the moisture in the gills.]

Flounder (*Pleuronectes flesus*). The only one of our flat fish which spends much of its time in fresh water, though it spawns only in salt. It is dark brown in colour, with darker mottlings, and there are small tubercles round the lateral line. Some curious tumours on the back in the breeding season are regarded by the fishermen, whose zoology is empirical, as eggs. The largest recorded flounder was just under 20 in. (Day gives 8 or 9 in. as the maximum length, an obvious misprint for 18 or 19.) It is mature at 7 in. for the female and at a little under 5 for the male, which, as in all flat fish, is the smaller.

Whitebait

Turbot (*Rhombus maximus.*) A broad fish, brown in colour and studded with rough tubercles. The under side, as in most flat fish, is white. (The so-called upper and under sides are in reality the left and right, as these flat fish undergo curious changes at an early age and swim henceforth on one side, with both eyes on the other.) The largest on record was a female of 28 in. A fish of 20 lb. would be considered much above the average.

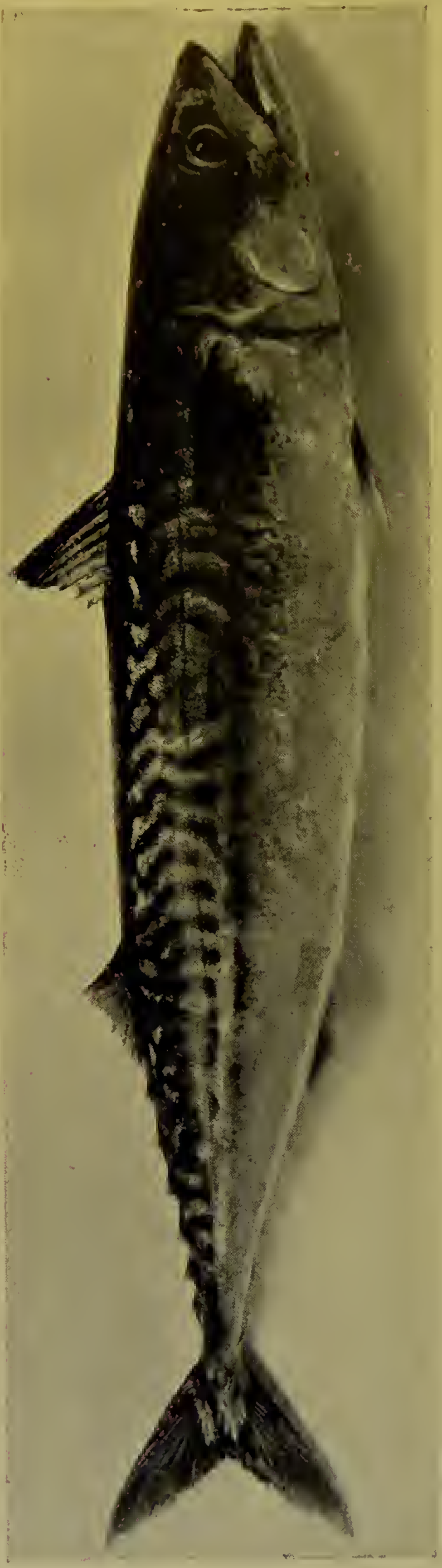
Brill (*Rhombus lævis*). A smaller fish, which does not, as a rule, exceed a weight of 10 lb. It is inferior in flavour to the turbot, but can easily be distinguished by the absence of rough tubercles. The brill has scales and is smooth to the touch. There is a female brill on record of 26 in. but this must have been very exceptional.

Halibut (*Hippoglossus vulgaris*). The largest of the flat fishes. Specimens have been measured of more than 20 ft., and these would weigh several hundredweight. Needless to say, it is a fish which sells in slices, and it is even palmed off on the unsuspecting buyer for turbot, to which it is very inferior. But its skin is smooth and without tubercles, a ready means of detection. It is longer than broad, dark brown in colour above and white below. The flesh is rather woolly. The confusion with the more delicate turbot is rendered worse by the fact that in some

HALIBUT

parts of Scotland the fishermen actually call this fish "turbot." It is found chiefly in northern waters.

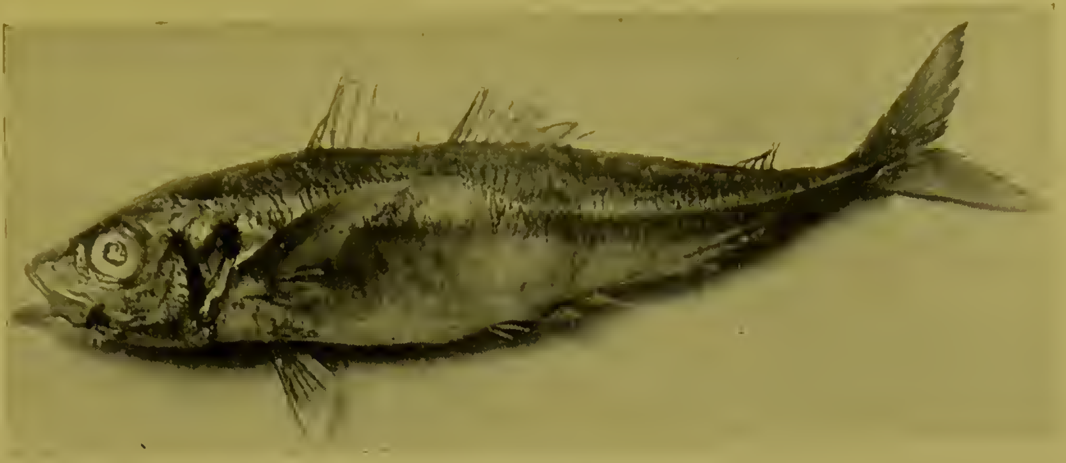
[There are other flat fish on the market of lesser importance, witches (*Pleuronectes cynoglossus*), megrims (*Arnoglossus megastoma*), long rough dabs (*Hippoglossoides limandoides*), and others, but the foregoing are those with which the ordinary buyer will have to deal.]



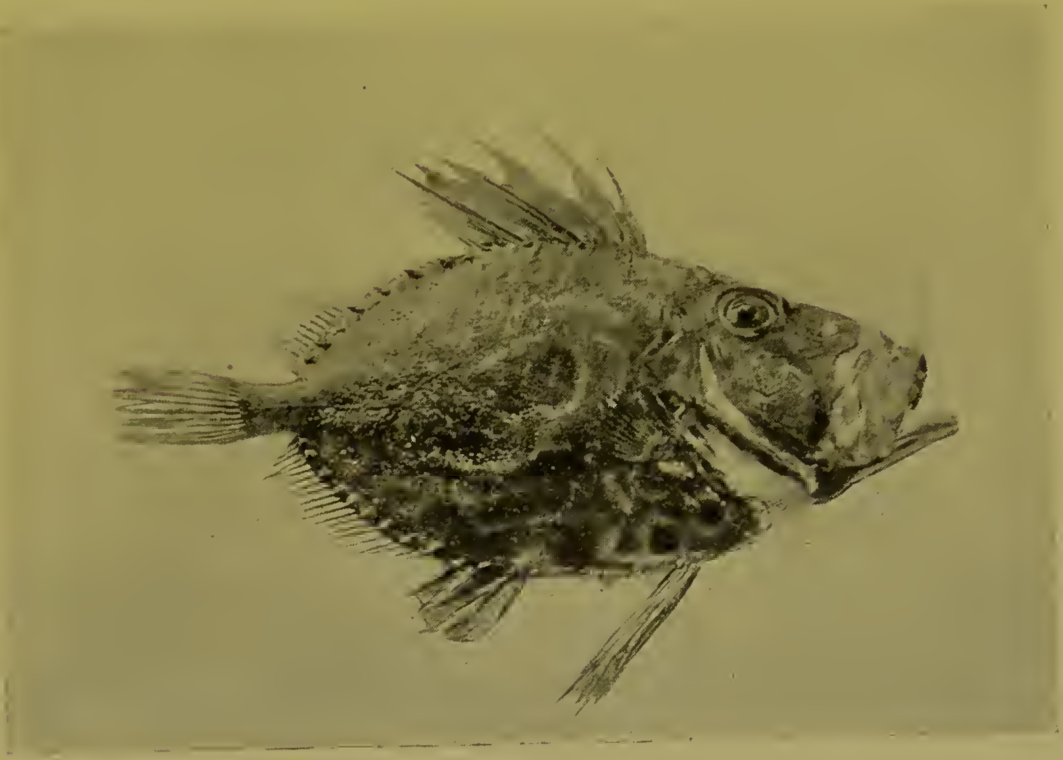
MACKEREL

The **Mackerel** (*Scomber scomber*) is a familiar fish, deep blue or light green along the back, with black bars or wavy lines down the sides, and silver with a pink sheen on the belly. The tail-fin is forked. The scales are very small, so that the mackerel is smooth to the touch. Mackerel keep badly and are injurious if eaten stale. There are small fins or finlets along the upper and lower edge, just in front of the tail. The mackerel, which swims in large shoals and is migratory, is widely distributed in warm seas, but also occurs on the Scottish coasts, though not so plentifully as in the English Channel.

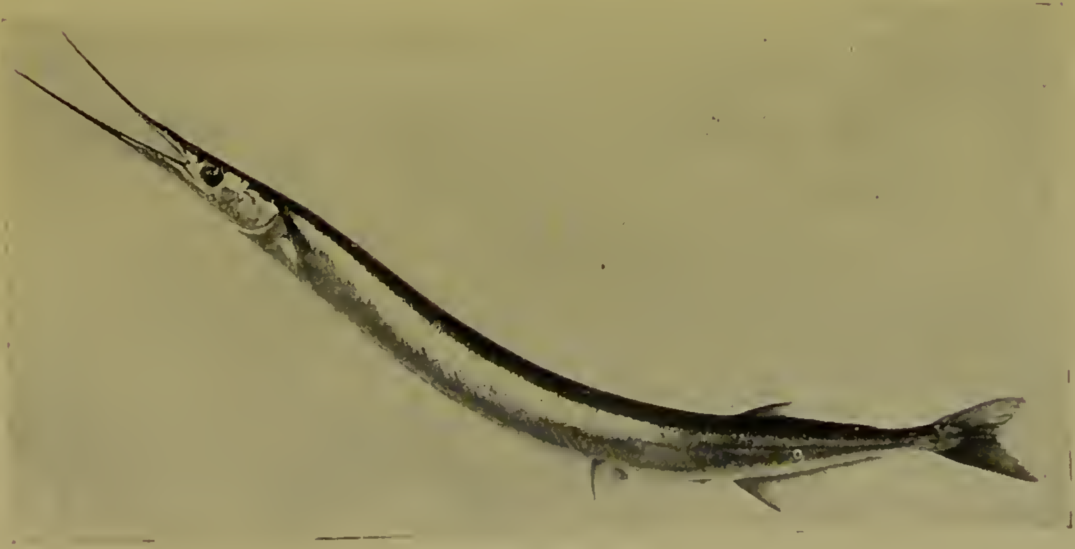
Dory or **John Dory** (*Zeus faber*). This is a very ugly fish and cannot be mistaken for any other kind. It is flattened, and the first thing which strikes one is the enormous size of the head and the curious tubular mouth, in which the upper jaw is often seen, in death, distended as when the fish is preying on sand-eels. The tail-fin is not forked. The back fin has long rays, and there is a long, sharp fin beneath the throat. When alive, the dory is a beautiful silver all over, but this is soon tarnished, and at the fishmonger's it is a dirty brown. The largest dory on record weighed 18 lb. (Cunningham). It is a fish of warm seas and is rare north of the English Channel.



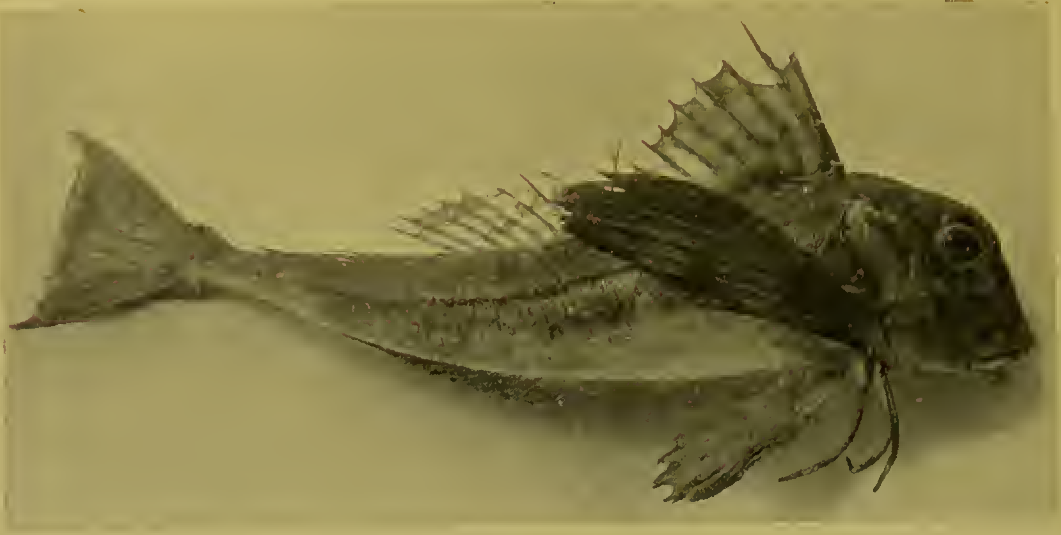
Scad or Horse Mackerel



John Dory



Garfish

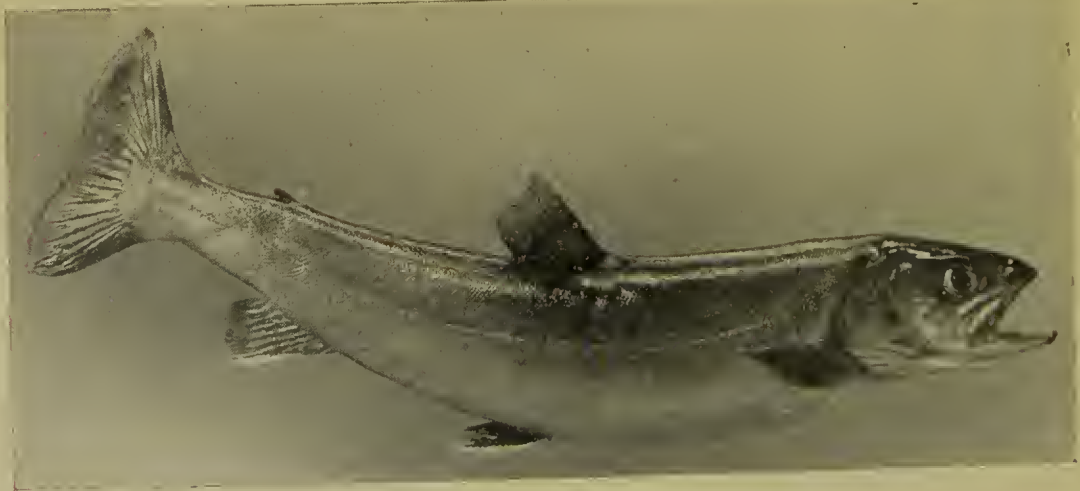


Gurnard

It is plentiful on the coast of Cornwall. In Lancashire, only small dory are found.

Garfish (*Belone vulgaris*). This fish is as distinct from all other British food fishes as the dory, though two fishes could hardly be more unlike. This form is silvery and eel-like, with a long bill not unlike that of a woodcock. The body is more flattened than in eels, the scales are small, and the colour is blue or green. There is only one fin on the back, and it is near the tail. The garfish grows to a length of a yard and is found all round the coasts of Britain and Ireland, usually in the company of the mackerel shoals.

Red Gurnard (*Trigla cuculus*). This fish, like others of the same family, has no soft skin over the broad bones of the head, and this gives it a curiously armoured appearance. Another peculiarity of the gurnards is the presence of finger-like rays on the fins under the head, with which, in fact, these fish feel their way over the ground and detect the presence of food. The red gurnard is the smallest of our marketable kinds and



Char (Lake Windermere)

Loch Leven Trout

does not exceed 18 in. It is red in colour, with yellowish white patches on the belly and under the head. The lateral line is ridged. All gurnards are spinous and must be handled carefully. The red gurnard is very common in the English Channel, but rare in the North Sea.

Grey Gurnard (*Trigla gurnardus*). This is a much larger kind, growing to 20 in. It is grey, with white spots, and has hard knobs along the lateral line. It is the commonest of the gurnards in northern seas and along the east coast, but comparatively rare in the English Channel.

Tub (*Trigla hirundo*) or **Sapphirine Gurnard.** This is a still larger gurnard, and grows to a length of 24 in. It is red, with bright blue on the fins. It is not common in the North Sea, though it is caught in some quantity on the east coast of Scotland, and is common on the south coast. (The Irish call this species the Grey Gurnard.)

Piper (*Trigla lyra*). This is the largest of our gurnards, growing to 26 or 28 in. It may be distinguished by the rough-edged bony plates on the head and is red in colour. It is plentiful at times in the English Channel, but not on the east coast or in Scottish waters.

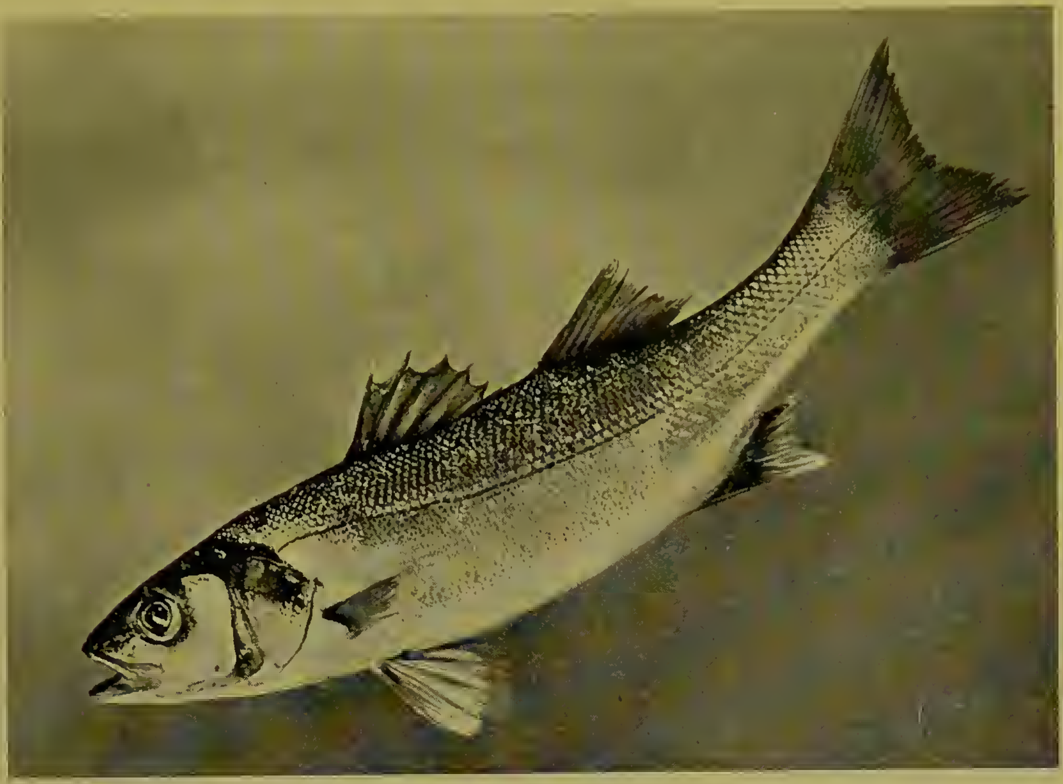
Bass (*Labrax lupus*). This is a silvery fish, related to the perches, though often sold by provincial fishmongers as "salmon bass," a

Lake Trout

Black-finned Trout or Bull

Eel

misleading name, as its flesh is white and somewhat woolly and it has no relationship to the salmon. It grows to a weight of at least 25 lb., and we have found the average much higher in the seas of Turkey than in England. It is a warm-water fish and at home reaches its greatest development in the English Channel and on the southern shores of Ireland. It is rare in Scottish waters and does not, in fact, occur regularly north of the Wash or the Menai Straits. It is not held in much esteem as a food fish in this country, but sells readily in Turkish fish markets at a shilling a pound.

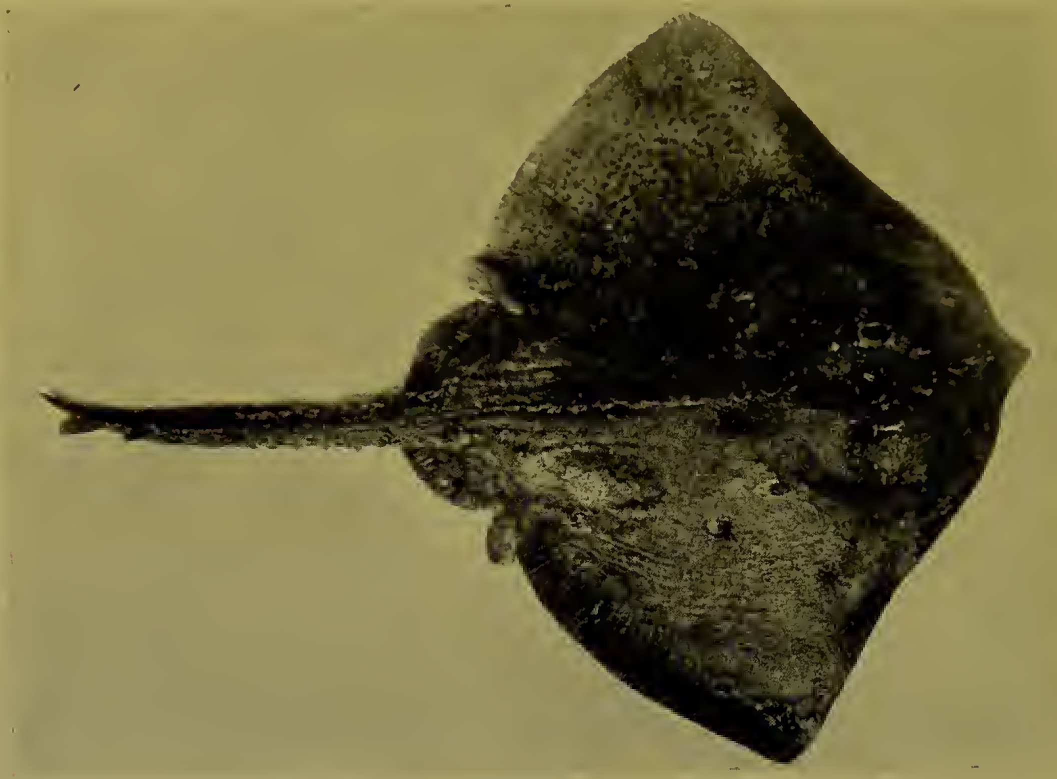


Bass

Grey Mullet (*Mugil chelo*). This silvery fish is, at first sight, not unlike a bass, but it has a smaller head and lacks the strong perch-like fin on the back. It grows to a weight of 15 lb., and there are at least three different species in British seas. It is a southern form and most plentiful in the English Channel, though it is also found in the North Sea. It is fond of entering estuaries and can live in brackish water. The teeth are so feeble as to be observed with difficulty.

Red Mullet (*Mullus surmuletus*). This is a red fish, with large, thin scales and two finger-like barbels under the head, which are tucked away when not in use. There is said to be only one kind in English seas, and that is most plentiful on the south coast. In Turkey, there are two, one of which grows much larger than the other and has a rounded head. If we have only one kind of English red mullet, it is curious that some should have yellow bands, which are absent in others. It grows to a length of 18 in. As it is usual for epicures to eat this fish "with the trail" (*i.e.*, not cleaned), it is necessary to purchase it absolutely fresh.

Eel (*Anguilla vulgaris*). This familiar snake-like fish is brown or green on the back and sides and white below and has such small scales as to be quite smooth to the touch. The eyes are very small, and the lower jaw protrudes beyond the upper. The female is larger than the male and grows to nearly 40 in. and a weight of 10 lb., but this is exceptional. Eels live to a great age and survive low temperatures. They can even be frozen in ice and thawed back to life. The so-called "sharp-nosed" eel is in reality the female, and the "broad-nosed" eel is the male. The "silver" and "yellow" eels of the trade are also merely two different conditions of the one and only eel in our rivers, the silver eel being about to go down to the sea to spawn, as these fish cannot deposit their eggs in fresh water. Eels occur in practically all muddy rivers in the British Islands, and in many clear streams, where they prey on the young trout and salmon. They are not esteemed as food in Scotland.



SKATE

[The **Conger Eel** (*Conger vulgaris*) is a large marine kind, more silvery than most river eels, with large eyes and no scales. It is not muddy like the river eel, but lives among the rocks. Conger, in which the female alone ever grows longer than 32 in., are caught weighing over 120 lb., but a fish of half that weight is above the average.]

Skate (*Raia batis*). This is one of the many rays which are sold in the fish market and is the most delicate. It is closely related to the sharks and dog-fish, and is a flattened, triangular fish, with a long and

Grey Mullet

whip-like tail. It is caught weighing over 224 lb., and varies somewhat in colour, as it is also known as the blue or grey skate. These fish have no scales, but a rough skin which, in some of them, is studded with curved tubercles. They also have no gill-covers, like the bass or grey mullet for instance, but each gill has an opening of its own, and the five openings, as well as the enormous crescent-shaped mouth, are on the lower side of the head. The eyes are large, and behind them are two slits, called spiracles, which enable the fish to breathe with comfort even when the gill-openings are buried in the sand. The skin of the female is smoother than that of the male, and 'the latter has a patch of tubercles on the side fins. Skate are usually crimped for the market, that is to say, bled after capture (and before death) and, when insensible, gashed across the body at short intervals. The fish is then thoroughly washed in fresh water. Many fishermen do not first bleed the fish, which makes the process more cruel and less efficient. As it is, many specialists are of opinion that by letting air play over the greater surface thus exposed,

Mullet (Red)

The fish here represented was of record size, measuring fifteen inches from head to tail.

crimping does more harm than good. It is supposed to make the flesh firmer.

SHELL-FISH

(*a*) Crustaceans

Lobster (*Homarus vulgaris*). This is a very familiar animal, dark blue, with yellow markings, when alive, and scarlet when boiled. It carries its skeleton *outside*; it has forty gills for breathing, some of them carried on the limbs and protected from sand by bristles; it has ten legs and two claws, as well as two long feelers (like the antennæ in butterflies), and six pairs of jaws, which work sideways like scissors. The claws are easily cast, in fighting, or even in a thunder-storm, as a result of which we often find lobsters with only one, or with one much smaller than the other.

When the lobster is growing too big for its shell, it casts it and grows another. This is done frequently when it is small, but more rarely when full-grown, and the shell of an old lobster is frequently covered with limpets and weeds. By the by-laws of most of the fishery districts of England and Wales, it is unlawful to take a lobster measuring less than 9 in. from the tip of the beak to the end of the tail, and "berried hens" (*i.e.*, the female carrying the spawn under the tail) are likewise protected on many parts of the coast.*

Crab (*Cancer pagurus*). This is easily distinguished from the lobster, being shorter and rounder and having no long tail to swim with. It is reddish and the claws are black. Crabs measuring less than 5 in. across the broadest part of the back are protected under the by-laws of many fishery districts.

There is an underground boiling-house at Billingsgate and some other markets, where shell-fish can be boiled at small cost. At Billingsgate, the charge for boiling lobsters is 3*d.* for ten, or 1*s.* 6*d.* for a large basket. There is also a plant for steaming them.

Prawn (*Palæmon serratus*). This is like a miniature lobster, but is almost transparent. It has a long saw-edged beak and small pincers, which distinguish it from shrimps. Like the lobster, it is scarlet when boiled.

Shrimp (*Crangon vulgaris*). A semi-transparent little creature, without the notched beak and pincers of the prawn. It is caught in the sand, whereas prawns are taken among the rocks. The common shrimp is brown when boiled, but there is another kind, also known as "prawn," which boils pink. Both in the Thames estuary and on the Lancashire coast the "pink" and "brown" shrimps are caught on separate grounds. Tons of shrimps and prawns have from time to time to be condemned and seized by the inspectors of the Fishmongers' Company.

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* The Sea Fisheries (Oyster, Crab, and Lobster) Act, 1877, prohibits the taking of lobsters measuring less than 8 inches, but this is subject to the by-laws of the Fishery Districts. The same Act protects edible crabs measuring less than 4¼ inches across the broadest part of the back, as well as those which are carrying spawn, or have cast their shell. As it is illegal not only to catch these undersized crabs and lobsters, but also to "have in possession, sell, expose for sale, consign for sale, or buy for sale," the Act interests all classes of the community. The only exception (and even this does not obtain on the East Coast of England) is in favour of small edible crabs used for bait. The penalty is £2 for the first offence and (under certain circumstances) £10 for every subsequent offence, and in both cases the crabs or lobsters are forfeited. "Berried" lobsters and crabs (*i.e.*, carrying spawn) are protected on the west coast of England and Wales, and "berried" lobsters from April to June (inclusive) on the coast of Northumberland.

(*b*) MOLLUSCS

Oyster (*Ostrea edulis*). This well-known bivalve lives in two shells and is attached to the concave left shell (scientifically known as "valve").

LOBSTER

The right shell is flat. (In the scallop, it is the right shell which holds the animal.) The oyster has no head, no eyes, no brain, and no foot. In place of the foot, with which many other molluscs attach themselves, it has a bunch of threads, called the "beard." An oyster is at its best when between 18 months and two years old. The "native" is one of the smallest and is also the best. If the shells gape, the oyster is dead and probably unfit for food. There is a statutory close time for British oysters (May 14 to August 4), but imported foreign oysters may be laid down for a few months in British waters and sold during the close time. This makes it possible to buy oysters all the year round (though it is a good rule to leave them alone during the four months without an "r") and it also makes it difficult to enforce the law. Oysters must be sold alive.

Cockle (*Cardium edule*). This is known by its round ribbed shells. It has a "foot," with the aid of which it can jump in the water. It is

Dublin Prawn

always indigestible, and often, when taken in unclean estuaries, dangerous, being a fertile source of typhoid. The estuary of the Teign, in South Devon, has an immense mud-bank, known as " Salty," from which millions of cockles must have been raked. Many tons are annually seized at Billingsgate.

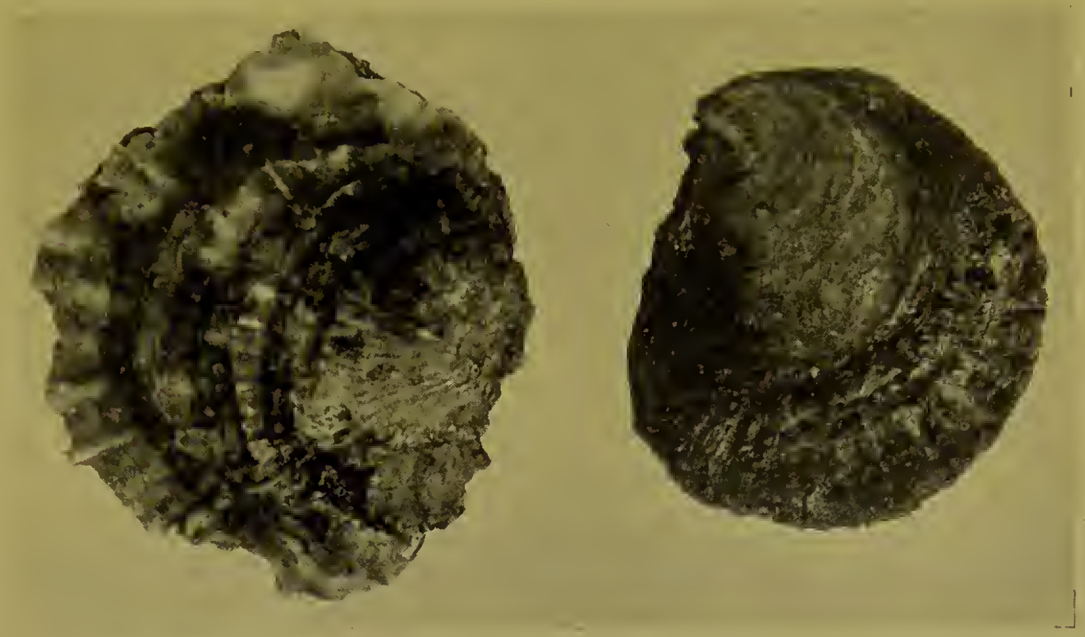
Mussel (*Mytilus edulis*). This is another popular cheap bivalve, though it is often eaten carelessly when unfit for food. Indeed it seems more risky than most shell-fish. It is a yellowish red animal in black shells, which grow in large bunches on rocks and wooden piers. Besides being consumed to an immense extent as food, it is in great demand for bait in the Scottish line-fishing. There are valuable mussel-beds off Ravenglass. Like the oyster, the mussel is the object of an extensive culture. It is also protected under the by-laws of several fishery districts. Thus the

Prawn

Eastern District specifies the instruments used for taking mussels and prohibits the taking of any mussel of less than 2 in. long.

Whelk (*Buccinum undatum*). Unlike the preceding, the whelk lives in a single shell, not unlike a snail's. It is an indigestible article of food, but in great demand in the poorer quarters of cities. Otherwise it has gained notoriety as a terrible enemy to the oyster-beds, and is much used as bait.

Winkle or **Periwinkle** (*Littorina littorca*). This is like a miniature whelk, and is gathered in enormous quantities on the Scottish coasts and elsewhere. It is a sea-snail, with the rounded spiral shell of its land cousin. Tons are condemned by the inspectors every year, and great care should be exercised in buying or eating any of these molluscs.



Oysters, Native

III. WHEN THEY ARE IN SEASON

It is exceedingly difficult to say when a particular fish is, or is not, in season. There is, in fact, no season at which (save legally) any fish is unfit for sale. All manner of lists are published, in calendars and in cookery-books, and most of them are misleading. In a general way, it may be laid down that a fish is absolutely at its best in "half-spawn," that is to say, with the roe about half ready for depositing, but there are fish which are in the pink of condition in full roe, and, on the other hand, immature fish (*i.e.*, those which are not yet old enough to spawn) are never out of condition, though in some cases they should be avoided for the sake of saving the race. The increasing long distances from which fish are brought to market under the stress of modern competition also render it more and more difficult to lay down precise and well-defined seasons. Thus cod used always to be regarded as a winter fish, but some admirable cod is nowadays seen at the fishmonger's shop in the summer months. Again, though plaice are very poor during the first three months of the year, soles are in good condition practically from January to December. Herrings in good roe used to be regarded as a winter fish, but thousands of boxes of herring in half-roe, caught in the north of Scotland, are found in south-country shops as early as the first week of September.

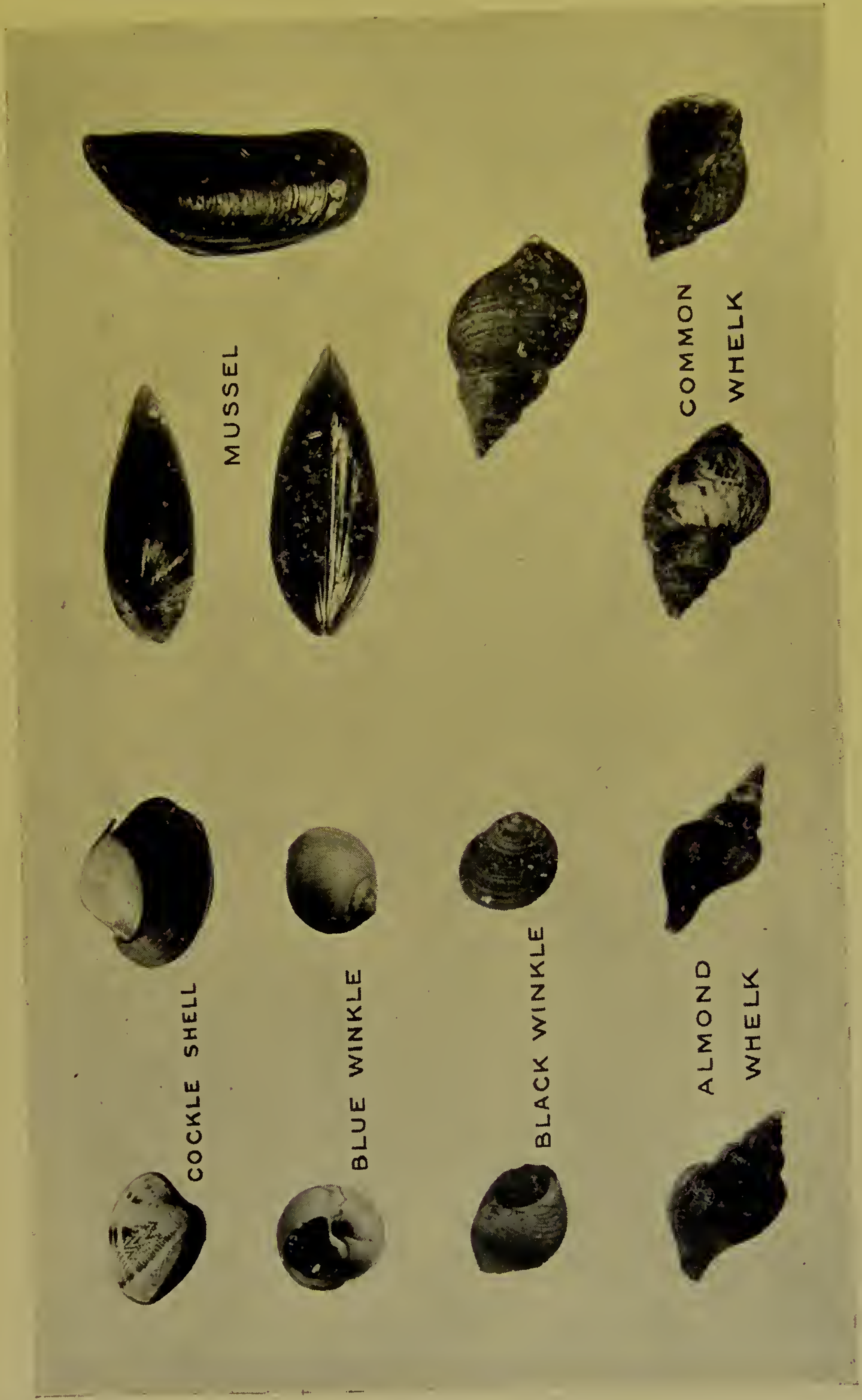
In the case of the herring and other migratory fishes, the "season" may be determined by the period during which the shoals come within reach of the fishing fleets, and without any reference to whether the fish, if caught and brought to market, would be fit for food.

Salmon are protected by special laws and Acts. Every river must be protected from the nets for not less than 168 days in Scotland and Ireland (or not less than 154 days in England and Wales), but the beginning and end of the season varies with different rivers. The period during which, speaking generally, it is unlawful to buy or sell British salmon is from September 3 to February 1 (both inclusive), but Dutch salmon may be sold in English markets between those dates. As, moreover, the law forbids the sale of *fresh* salmon only, it would be possible to kipper salmon caught out of season and to sell it as cured fish.

From the buyer's point of view, again, fishes which deteriorate rapidly in warm weather (such as mackerel and whiting) are best in the cold months, though, if perfectly fresh, they may be in season all the summer.

As regards shell-fish, oysters are usually avoided in the months which have no "r" in their name (*i.e.*, May to August inclusive), and are not, indeed, worth much even in September. There is a statutory close time for them (May 14 to August 4 inclusive), but American "blue points" and other foreign breeds may be laid down in British waters for a few months and then sold during the close time for "natives," so that oysters of a kind may be bought all the year round. Lobsters are always in season, so far as being fit for food is concerned, but on most parts of the coast the females are protected during the time when they are carrying the eggs and are known as "berried." Both they and crabs are also protected by some of the Fishery District by-laws when they have just cast their shell.

The legal "seasons" for fish and shell-fish are known to all buyers, and are posted in the markets for the benefit of new-comers. Apart from these, which must be strictly observed, there is nothing to guide the buyer but the condition of the fish, about which more will be said later. It is quite possible that plaice from some distant ground might be in prime condition in January and February, even though that fish is then spawning on our own coasts. Cod, which spawn a little later in the year, have not usually recovered by the summer, but, as was pointed out above, plenty of cod in excellent condition was sold during the past summer (1909).



Typical Specimens of Shell-fish

IV. HOW THEY ARE BROUGHT TO MARKET

The bringing of fish from their native haunts to the market involves the twofold processes of production and distribution, that is, first catching it and then bringing it to the buyer. This commercial use of the word "distribution" must be distinguished from natural distribution of the different fish in warm or cold seas, of which something was said in an earlier section.

(1) PRODUCTION. The methods by which fish is caught may be very briefly reviewed. They consist of various nets and of baited lines and traps.

The chief nets are the **Trawl, Drift-net, Seine** (or **Sean**) and **Trammel.**

The **Trawl** is an immense bag or purse of net perhaps 80 ft. long, the mouth of which is kept open (when used with a sailing-boat) by a 40-ft. pole of oak or elm, or (when used with a steamer) by the action of two "otter-boards," which fly apart on being towed through the water. The trawl is dragged for a certain time over the bed of the sea, care being taken to avoid areas of rocks, which would tear the net, and is then hauled over the deck, a slip-knot pulled and the contents emptied out on board. The fish chiefly taken by the trawl are the cod, haddock, hake, ling, whiting, sole, plaice, brill, turbot, gurnards, and skate. Fish caught in the trawl are, for obvious reasons, more bruised than those taken on lines. They are also dead when removed from the water, as there is a great pressure of weed, stones and other *débris* in the net. Unfortunately the trawl, sweeping up everything in its path, kills millions of undersized plaice and other flat-fish. Experiments have been made with a view to letting these escape while still alive, but this is found practically impossible, and the only hope is that the trawlers may be induced, by legislation or education, to keep off certain "nurseries" known to be frequented by these under-sized fish.

The **Drift-net** is a wall of fine-meshed netting, which is kept stretched by corks on the upper edge and by leads on the lower, and which is made to move through the water parallel with the shoals of herrings, mackerel, or pilchards and in such a position that the fish, which are in the habit of leaving the neighbourhood of the land about sunset, strike against the net and get their gills caught in it, thus suffocating themselves. For this reason the Americans call it a "gill-net." The Scottish fleets follow the mackerel all round the coasts of Britain, catching them off Whitby, Scarborough, Yarmouth, and all along the south coast to Cornwall, and the bays of Ireland. The fish are dead when removed from the net, and more than 95 per cent. strike the same side of it, so that it is easy to shake them out in their thousands on the deck of the smack. The Scottish drift-nets are of fine cotton, for the coasts of Scotland are rocky, with clearer water than on the mud-banks off Norfolk and Suffolk, where coarser nets are used. A herring-net may be 120 yds. long, but for mackerel one of half the length is used, and each boat may put out twenty nets or more. As many as six hundred millions of herrings have been landed at Yarmouth in the course of a year.

The **Seine,** or **Sean,** which is also kept stretched with corks and leads, is a purse-like net which, with the aid of boats or otherwise, is got round the salmon when running up rivers, or the herring, pilchards, sprats, mackerel, bass, or grey mullet in the open sea. The fish are either hauled on the beach or dipped out into boats if caught in deep water, and they are alive when removed from the water. When used in rivers for salmon, the seine is subject to all manner of restrictions, not merely being forbidden during more than one-third of the year, but also prohibited from working too close to another net or right across the stream.

The **Trammel** consists of three nets, which stand upright in the water and parallel. The inside net of the three is double the length and height of the other two and has a smaller mesh. What happens is that when a fish swims through the large mesh of either of the outside nets and comes in contact with the small-meshed loose folds of the middle net, it dashes forward through the large hole in the third net, carrying with it a fold of the middle net and thus shutting itself in a pocket from which escape is impossible. In our seas the trammel is usually put down towards evening among the rocks and taken up next morning, but in the Eastern Mediterranean, where it was originally invented, it is taken up at once, stones being thrown in the water to frighten the fish into it. The chief fish caught with the trammel are red mullet and bass, and a number of lobsters are also taken.

In addition to these, the chief nets of our seas, there is also what is called a stow-net for catching whitebait in the estuaries of rivers. It is a kind of fixed trawl, the mouth being kept open by the action of the tide.

Lines, with baited hooks, are either held in the hand or laid down on the bottom of the sea. The latter may carry thousands of hooks. The hooks are baited with pieces of fish or with whelks, mussels, or lugworms. The fish so caught vary from enormous skate, halibut, and cod to the smaller flat fish, whiting, and mackerel.

Lobsters, crabs, prawns, whelks, and winkles are taken in various patterns of baited traps or "pots," usually made of wicker-work. Shrimps are caught in small trawls or with push-nets; oysters are dredged, and cockles are raked.

(2) DISTRIBUTION. The commercial distribution of fish by rail or otherwise must not be confused with their natural distribution in cold or warm seas, about which something has already been said. Thanks to railway and steamer development, thousands of tons are brought the thousand miles from Iceland to Billingsgate. Most of this, perhaps, comes in the Hull steam-carriers, by what is known as the "fleeting" system, no railroad being utilised, but the fish being collected from the fleet on the fishing-grounds by fast steamers and thus brought to the Thames-side market. Some forty thousand tons come in this way every

year. Ice and steam are the important factors in this system, and the water-borne fish escapes the necessarily heavy railway freights.

Keeping Fish Alive. Fish caught in the trawl are dead when taken out of the net and must be sent packed in ice. The same applies to those fish which are caught on long-lines, as, having, perhaps, been for hours on the hook before their removal from the water, they are either dead when taken out or too exhausted to recover. These also must be packed in ice. If, however, caught on hand-lines, the cod and halibut are hauled immediately they take the hook, and it is usual to keep many of them alive, either tied by the tails or free, in welled smacks, as many as a thousand cod in each well. The water passes freely in and out of their prison, but they get no food but that which they can find in it. On arrival in port, they are transferred to a perforated chest and sunk in the dock until required for sale. This custom of bringing living fish to market is honoured by time and that is about all. It is exceedingly cruel, as the fish slowly die of starvation. It is also unsatisfactory apart from this, as the flesh grows woolly, and bacteria are encouraged to multiply in the blood by such conditions. Lobsters are also kept alive in the same manner and many die of starvation, though if well watered by the fishmonger they retain their fresh appearance for some little time longer.

All fish should be killed as soon as caught, and then gutted, washed, and salted.

Fish by Rail: Anomalies of Distribution. The bulk of the fish sold in the markets comes by rail, and the railway companies have to maintain well-equipped departments to deal with this traffic alone. It is computed that the great companies carry between them close on a million tons a year, a wonderful change from thirty or forty years ago, when Christchurch salmon and Leigh shrimps used to be sent to London each night by coach and cart. The fish sold at Billingsgate may have been caught as far distant as the cold seas of Iceland or the warmer waters on the coast of Portugal. The trade is so complicated to-day that some curious anomalies confront any one studying the subject. Thus, although Grimsby receives more trawl-fish than any other three ports in the United Kingdom, it has to take truck-loads of fish by rail from Milford Haven. We have heard of a Scottish dealer buying large quantities of lightly cured cod at Hull, fetching them by sea to Scotland, there curing them more highly, and then sending them by rail all the way to Devonshire. On Brighton beach we have seen mackerel, which had paid railway rates from Cornwall, bought in preference to other mackerel landed at the same time on the beach by the Brighton boats, for the Cornish mackerel were the fresher, having been alive the morning before, whereas those caught by the Sussex men had been netted nearly a hundred miles away and had been three days on ice. It is a curious reflection that a slice of turbot eaten in a London club may have been caught in the Bay of Biscay, then brought on ice to Plymouth Barbican, sent by South-Western Railway to Waterloo, thence by van to Billingsgate, and finally by cart to the

Bond Street shop from which the club buys it. A moment's consideration of the price in the West End and of all these intermediate profits will show how little is left for the catcher.

"Prime Fish" and "Offal" Rates. For trade purposes, fish is divided into two categories: prime and offal. The latter, usually offensive, term does not imply unfitness for food, but merely embraces such kinds as cod, haddock, hake, plaice, lemon-sole, and herring, which, many years ago, when the more delicate "prime" fish (salmon, red mullet, sole, turbot, and whitebait) were more plentiful and the facilities for transport by rail less helpful than they are to-day, were sold cheaply at the coast, it being impossible to pay for transport inland on these cheaper sorts. The railway rates vary according to the quality of the fish and also whether it goes at the company's or owner's risk. As regards quality, the rates differ. A ton of prime fish can be sent from Lowestoft to London (over 100 miles) for 33*s*. 9*d*. at the company's risk, and five tons of herrings can be sent from Yarmouth to London (over 120 miles) at owner's risk for £3 3*s*. 4*d*. The railway rates are very high compared with those of water-borne fish. It would probably cost more to send fish from the north of Scotland to London by rail than to Australia by water. Yet the fish-trains carry tens of thousands of tons all over the country, either packed in boxes or else in open tanks. The latter plan has the advantage of allowing less handling of the fish, and there is no trouble with returned empties, which, accumulating in thousands at the coast, are a continuous source of dispute between the trade and the railway companies. The strain thrown on the carrying companies is much greater in these days of steam than in the old sailing days because the fishing fleet could then be seen hours before it reached the port, giving ample time for getting the necessary trucks, whereas nowadays a steamer is alongside within a few minutes of being sighted.

The Owner's Risk. Fish can be sent by rail at either the company's risk or the owner's, the latter, of course, at a cheaper rate. Thus a hundredweight of fish sent from Grimsby to London would cost 2*s*. 8½*d*. at the company's risk, but only 1*s*. 6*d*. at the owner's. The fish merchants complain that the higher rate is prohibitive in the present state of the market. The companies retort that they must please themselves, but that they should not expect to pay the lower rate and shelve all the responsibility. Under the risk-note used by the majority of railway companies, the company is freed from all liability for "loss, damage, misdelivery, delay, or detention," unless the aggrieved party can prove that such loss, &c., was due to "wilful misconduct" on the part of servants of the company. In the latter event a claim lies for compensation, and this is settled by the Claims Conference at the clearing-house.

At the Market. The fish has now to be sold. This is done by salesmen, and the buyers are either retail fishmongers, who attend the auction for that purpose, or, more often, fish merchants, who buy the fish, selling some to the retail fishmongers and curing the rest. Thus the salesman sells the catch of the fishing fleets, charging commissions which are high enough to cover the risk of bad debts. The fish merchant may retail his purchase to the fishmonger, or he may cure the fish for sale later. Most fish merchants combine the two, so that their business is divided into two branches, fresh and cured. Such bruised or inferior fish as he buys, which he may not think good enough for either the fishmonger or the curing-house, he disposes of to manure factories, which also buy up tons of condemned fish.

V. HOW THEY ARE BOUGHT

The ordinary way of selling fish, whether in the great markets or on the beach at the port of landing, is by auction. In some parts of the country it is the custom to sell by Dutch auction, *i.e.*, the seller names a high price and comes down until a buyer meets him. The white-coated salesmen are very clever and experienced in dealing with great quantities of fish in the shortest possible time, and a busy morning at Billingsgate is something to remember. From the buyer's point of view, it is above all important to know whether a fish, or a parcel of fish, is fresh or not.

To tell Fresh Fish from Stale. Now it is first necessary to be quite sure what is meant by such relative terms as "fresh" and "stale," for there are as many shades as between good and evil. Absolute freshness is not requisite in order that a fish should be quite good to eat, and some kinds, like cod and turbot, are better eating the day after capture, whereas mackerel, eels, herrings, and, in fact, all fatty fish cannot be eaten too soon after they are taken from the water. Oily fishes, like herring and mackerel, "go off" more rapidly than the firmer cod and turbot, and greater care is therefore necessary in buying them. It is a sound rule to avoid bruised fish. Fish caught in the trawl are, for obvious reasons, more bruised than those taken on lines. Not only are the fish injured by stones and weed while being pulled through the water, but the net is often emptied by night, and the fishermen trample on the catch in the darkness with their great sea-boots, doing much damage. Decomposition sets in more rapidly in bruised fish, and this is one of the arguments against crimping.

There are several ways of telling a perfectly fresh fish. Smelling it is of little use, for not only does the sense of smell vary in different people, but a fish may, for sound reasons, be either fresher or staler than one would gather from its odour. Moreover, if fish is washed daily, the tainted smell is retarded. A sign of advanced decay is a phosphorescent appearance in the dark, but this is a test adapted for private use only and inapplicable in the markets, where dark-rooms are not provided for such examination. Dulness of the eyes is a reliable sign of staleness, though it is a severe standard, for the eyes grow dull within twenty-four hours of death and long before the fish can be described as in a state of putrefaction. If the scales are dull, and particularly if they rub off easily, the fish should not be bought. If the flesh comes easily away from the backbone, the fish should be thrown away or condemned. The gills should be red, but there are differences. Thus, in the haddock and whiting the gills are not the same deep red as in salmon. On the second day after death the gills grow paler, though judicious washing will make them keep their bright colour longer. A very fair test of a perfectly fresh fish is to hold it horizontally by the head and see whether it remains stiff or whether it droops. Any limpness is a sign that it is not perfectly fresh. The flesh should also be firm to the touch. Even when a fish is not stale enough to smell unpleasant, such softness is a sign of coming decay.

Perhaps the most important indication of freshness is what is known as *rigor mortis*, that stiffening of the muscles after death for a period which varies with different fish, lasting longer, for instance, in salmon than in whiting. It is indicated by the stiffness of the fish. When it is passing off, the fish becomes soft to the touch and easily "pits" if the fingers be pressed into the flesh. It may set in twelve hours after death and may last for twenty-four hours. It is found to last longer in healthy fish that have been killed as soon as caught and kept on ice. It is too late to put fish on ice after *rigor* has passed off; at any rate it decomposes more quickly. It also sets in and disappears more rapidly in trawl-caught fish than in line-fish. During *rigor*, litmus-paper indicates an acid condition, and during decomposition an alkaline, but this, again, is a test for the laboratory and not for the fish market.

To summarise these tests:

(*a*) Smell: unsatisfactory.
(*b*) Phosphorescence: unpractical.
(*c*) Dulness of the eyes: reliable but severe.
(*d*) Scales dull or easily detached and flesh coming away: reliable.
(*e*) Bright redness of gills: reliable, but needs discrimination.
(*f*) Stiffness when held horizontal and firmness: reliable.
(*g*) *Rigor mortis*; most reliable of all.

Inspectors must, of course, be acquainted with all these signs, and, so far as Billingsgate is concerned, the inspectors of the Fishmongers' Company condemn all unsound fish. The company is always willing for its inspectors to assist novices learning the business of inspection.

As much as 1500 tons of fish has been condemned in a single year. It is placed in hermetically sealed tins and handed over to a contractor, who receives £250 a year from the Fishmongers' Company and such profits as he can make on selling the condemned material for manure. The present price of fish manure is less than £5 per ton, and so great is the proportion of water that five tons of fish go to one of manure, but, even so, the contract is a paying one. The Fishmongers' Company holds the right to inspect and condemn the fish of Billingsgate under a Charter granted by James I., which gives "the full and entire Survey, Search, Government, and Correction of all and singular Persons, Denizens and Strangers, and of all others whatsoever, of whatsoever Art or Mistery they shall be, selling or having, possessing or keeping, to sell, any salted Fish, salted Herrings, fresh Fish of the Sea, Salmons, Stock Fish, or any other Fishes whatsoever . . . and to enter into any House, Shop, Ship, Cellar, Wharfe, and other Place and Places whatsoever . . . and to view, search, and survey wither the same be wholesome for Man's Body, and fit to be sold or no . . . to take and seize and thereof to dispose and do, according to our Laws of England. . . ."

These are full powers, and the company has always exercised them admirably.

A few general notes on the purchase of different fish may be of use :

Cod should be very firm to the touch.

Herrings are red about the head after capture, but in mackerel this redness denotes staleness.

Skate must be thick and firm, and the flesh pure white.

Eels live long out of water, and should be bought alive.

(A dead eel goes bad as soon as most other fish.)

The flesh of turbot, even quite fresh, is not such pure white as that of whiting. Whiting soon deteriorate and are easily damaged in packing.

Price of Fish. It is impossible to give the inexperienced buyer any accurate estimate of the price of any particular fish at a given season of the year. These figures are regulated by supply and demand in the auction-room. The best advice we can give is that he should purchase the current copy of the *Fish Trades Gazette.* It costs 2*d.*, and is published at 5 Arthur Street, close to the Monument, but may be bought for the current week at most of the railway bookstalls. It gives a weekly list of prices at Billingsgate for each of the six days of the preceding week and constitutes a reliable guide to the average wholesale prices obtained. It is a very complete list, with the following items: salmon (English, Scotch, Irish, Dutch, Norwegian, and frozen), grilse, salmon trout, soles, slips, red and grey mullet, dory, turbot, brill, plaice (large, medium, small, from Iceland and from the White Sea), lemon soles, halibut, cod (live and dead), mackerel, whiting, whitebait, smelts (English and Dutch), witches,* megrims,* hake, gurnet, latchets,† bream, haddocks (large, medium, small, or from Iceland), skate, roker,‡ eels (live and dead), conger eels, herrings (fresh English or Scotch and salted English, Scotch, or Irish), dry haddocks, bloaters, kippers, red herrings, fillets, lobsters, crabs, oysters (Natives, Dutch, French, Portuguese, or American), periwinkles, whelks, mussels, prawns (large and small), and shrimps (English, brown or pink, and Dutch).

"Lots," Boxes, &c. Not all fish are sold in the same way. There are even discrepancies which are puzzling to the uninitiated. Thus, a "hundred" herring are really 132, whereas a "hundred" mackerel, pilchard, or whiting are only 120. A "lot" of cod never numbers more than six fish, but a "lot" of ray may number fifty. A "box" of gurnard may weigh 70 lb., a "box" of haddock or whiting may weigh 80 lb., and a "box" of plaice or lemon-soles may weigh 100 lb.

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* These are flat fish.

† Another name for the Tub gurnard.

‡ Another name for the ray.

There are similar differences in the sale of shell-fish. Cockles, oysters, winkles and mussels are sold by the "bag" of about 80 quarts. On the other hand, prawns and shrimps are sold by the "basket" of about 48 quarts.

Tricks of the Trade. This is rather a delicate subject. It may at once be stated that reputable firms do not indulge in the petty frauds which attract smaller dealers. On the other hand, just as there is adulteration in other trades, so the buyer of fish has to be on the look-out for plausible deceptions, and this applies more particularly to the retail fishmonger in a small way, though many of the small traders are as honest as the greatest houses in the trade. Among the favourite tricks of the street hawker is that of palming off slices of halibut for turbot. The whole fish is, as has been shown, so easily recognised that he stands no chance of deceiving any one who has seen both, but a slice is less easily detected. The best safeguard is never to buy a slice of any fish that has been skinned, for the skin is usually the best means of distinction. Thus, the skin of the halibut is smooth, whereas that of the turbot is covered with rough tubercles. Brill, with its smooth skin, could be more easily imitated with halibut, but brill fetches very little more than halibut, so the fraud would not be worth the risk of detection.

Skinned weever is also sometimes sold for sole, and here again the caution against buying fish without the skin applies, for the skin of the weever has much larger scales than that of the sole and is also lighter in colour. It is said that fillets of cat-fish (*Anarrhicas lupus*) are coloured yellow and sold for haddock, but of this the evidence seems inconclusive. Bass are sold as "salmon bass," implying some connection with salmon, whereas there is none. Similarly, lemon-soles often figure on the menu of some hotels as "soles," to which they are very inferior in flavour; and the atherine, or sand-smelt, is occasionally sold for the true smelt, a fish of far more delicate flavour.

These are actual cases of passing off one fish for another. Among the tricks played on unsuspecting customers in order to induce them to buy fish which is no longer quite fresh, several call for mention. Skate are rubbed over with sand to make them look newly caught, and lobsters are filled with pieces of white fish to remove the shrunken appearance and bring up the weight to that of a healthy specimen in good condition. Minor frauds include potting sprats as "anchovy paste" and canning mussels as "oysters." Fillets of dog-fish have been sold for cod before now, though only to purchasers so ignorant of both that it seems hopeless to protect them.

Cured Fish. In view of the perishable nature of fresh fish, even with such aids as ice and salt and fresh water to postpone the inevitable decay, a great portion of that which is caught would have to be wasted if it were not for the different methods of curing or preserving it. Fish may be salted, smoked, dried, packed in barrels, or preserved with oil in tins. It is often objected, not without reason, that the business of curing is not under sufficient supervision, and it is a fact that many of the herrings and other fish smoked for sale on a small scale are prepared under conditions anything but sanitary. In some great ports, however, where much of this curing is carried on, the curer is under the inspection of the medical officer of health and is compelled to keep his premises clean and ventilated, to get rid of all the offal as quickly as possible and to give notice of diseased fish on the premises. At Hull, the curers are not even allowed to keep dogs on the premises.

The chief fish cured by one process or another are the salmon, char, herring, pilchard, sprat, mackerel, haddock, cod, and ling. In addition to these, there is a trade in potted shrimps and canned oysters.

Salmon. Smoked, or kippered, salmon is an expensive article, and is more in demand in continental countries, but is also found in the English and Scottish markets. It is only lightly smoked.

Herring. This fish is cured in a variety of ways, the best known of which are the bloater, the red herring, and the kipper. Herrings destined for the curing-house are not gutted when removed from the sea, but are washed clean of the salt they were packed in and put in fresh salt. The finest are then set aside for making bloaters.

The **Bloater** is a herring that has been lightly salted, for a day or less, and then lightly smoked, being hung for a day in the smoke of peat or wood. Very mild bloaters are those which have been merely wind-dried, and some people prefer these. As the herring is not split, the roe is left in. Both bloaters and kippers should be eaten before there is any suspicion of decay. It is quite a mistake to suppose that, because they have been cured, they can be kept indefinitely before being eaten.

The **Red Herring** is the same as a bloater, but is much more highly cured, being both more salted and more smoked, which gives it a very strong flavour distasteful to many people.

The **Kipper,** which must be prepared from *fresh* (not salted) fish, is a highly cured herring that has been split and gutted. It is then put in strong salt for a fortnight and is smoked for another fortnight, not continuously, but with alternative periods of cooling. The herrings are strung on sticks of twenty-five and are hung in dense smoke from smouldering oak logs. The fires are allowed to burn out every two days, and the fish then cool, while the oil drips out of them. The fires are then relighted. The alternating smoking and cooling continue for a fortnight, at the end of which the kippers are done. If intended for export, they are then packed in barrels containing from 500 to 800 apiece. For the home market, smaller numbers are packed in boxes. Kippering is carried on on a large scale on the east coast, but the process is unknown in Ireland.

White Herrings. These are the famous Scottish "wet" herring, packed in barrels for export to Germany and other northern countries. It is these that are prepared by the Scottish women who accompany the fleets round the English coast for the purpose. A million and a half of barrels have been cured by them in a single year. The "Crown Brand" is optional, and some curers prefer to use their own. On the other hand, it is accepted abroad as a guarantee of quality, and many continental buyers will have nothing to do with barrels that do not bear it.

Yarmouth, one of the greatest herring ports south of the Tweed, cures its herrings in barrels in the *dry* state. In this process, the fish are not gutted but are smoked. Whereas the *wet* herring is bought up by northern countries, the *dry*-cured fish go to the Mediterranean.

Pilchards are cured in a somewhat different fashion, and Cornwall is the centre of the industry. They are packed in rough salt for a month, in underground cellars, until all the oil has run out. Then they are washed and packed in barrels. The process is not yet complete, for they have now to be kept under heavy presses to squeeze out still more of the natural oil. When ready, they are packed in barrels of two or three thousand and sent to Italy. It is one of the ramifications of the trade that we should export our salted pilchards to the south of Europe and that the south of Europe should send us back its own pilchards tinned as "sardines." The "sardine" of commerce is, in fact, a young pilchard in a special preparation of olive oil.

Cornish Sardines. Many attempts have been made to manufacture sardines in this country. For years, sprats, which are inferior in flavour, have been tinned under that name at Deal and Folkestone, but Cornwall has come nearer removing the reproach, and at Mevagissey there is, in fact, an establishment at which the pilchard is so prepared. Unfortunately, the pilchards caught by our fishermen are rather larger than the fish used in the best brands which come from Nantes ; otherwise the imitation is fairly good.

Mackerel. This fish is smoked, split like a kipper or smoked haddock. The factory at Mevagissey also kippers mackerel, using the large Irish fish for choice, packing them in oval tins, each of which holds one fish and a half. The fish are beheaded and cleaned, then highly smoked, soldered down in the tins and cooked up to a temperature of 220° Fahr. The contents, it is claimed, keep sweet for years. Mackerel is tinned elsewhere in England and Scotland, and is cured at Lowestoft in barrels for export.

Haddock, Cod, Ling, and **Torsk** are all smoked, and smoked cods' roes are a favourite article.

Char is potted.

Shrimps are potted, particularly at Southport and some other Lancashire stations, stewed with butter and packed in pots, with a layer of Dutch butter to keep the preparation sweet.

Works of Reference. Those who wish to study the subject further may be referred to the following works :

"Report by Two of H.M. Inspectors on the Conditions of Work in the Fish-curing Trade of the United Kingdom" (Home Office), 1888.

Murie: "Report on the Sea Fisheries and Fishing Industries of the Thames Estuary" (Kent and Essex Sea Fisheries Committee), Pt. I., 1903.

Anderson: "Report on Decomposition of Fish" (Fishery Board for Scotland).

Aflalo: "The Sea Fishing Industry of England and Wales," 1904.

Williamson: "Fishing Industry Accounts," 1903.

CHAPTER X

THE HANDLING AND INSPECTION OF FISH

Cod-fish. As will be readily gathered from our illustrations in these pages, immense quantities of cod-fish are landed in the various fishing markets, and some of these fish reach an extremely large size. The photographs here reproduced refer chiefly to the market in Aberdeen, one of the largest and best fish markets in the country. An illustration on a later page represents an unusual fine catch of cod, eleven in number, which were sold in this market in Aberdeen in March 1908. The fish in this batch average no less than 77 lb. weight each, and their size and general appearance can be well estimated by comparing them with the man in the photograph. Illustrations on the preceding page show catches of cod laid out in the fish market along with halibut and skate and hake, together with the boxes in which they are packed and the trawlers in which they have been brought. In one of them a cargo of loose cod-fish just delivered is shown in the centre of the picture, in the foreground of which are the large pickling-tubs, while in the left of the figure the dried cod-fish can be seen stacked up.

As far as Scotland is concerned, most of the cod-fish are pickled, being gutted and bled as soon as they are caught and taken off the hooks ; if they are not immediately packed in boxes by the fishermen they are carefully covered to prevent their being affected by the sun or the air.

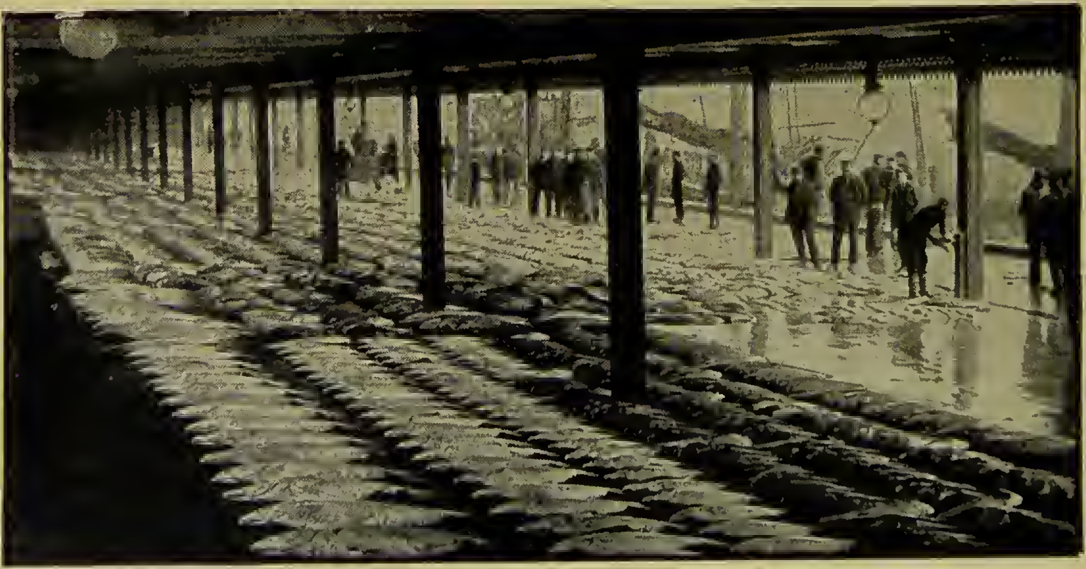
As soon as they are brought to shore the cod-fish are "headed," and then thoroughly cleaned by means of brushes in fresh water and then split ; the backbone is cut at an angle at a position which is twenty or twenty-two joints from the tail, the cut extending over more than one joint in order to strengthen the carcase of the fish. By making an incision over the remaining bone a more perfect bleeding of the fish is secured. After the splitting, the fish are once more washed in salt water and the black membrane is removed ; they are then pickled in covered vessels, the proportion of salt used being 45 to 50 lb. to 100 lb. of dried cured fish.

Dealers in dry salted cod say that considerable quantities of fish of this kind leave Scotland for Antwerp, whence it is re-exported to Spain and Havana ; the packing and curing, however, do not seem to be sufficiently good to compete successfully with the Dutch market, and an improvement in this direction would result in a considerable extension of this branch of the business.

Wet and salted cod are sent from Scotland in considerable quantities to Antwerp now, and this branch could be extended if those who are

Yawls and Trawlers at the Aberdeen Wharf

Exterior View of the Aberdeen Fish Market



Interior of the Aberdeen Fish Market
The fish are laid out in half-scores.

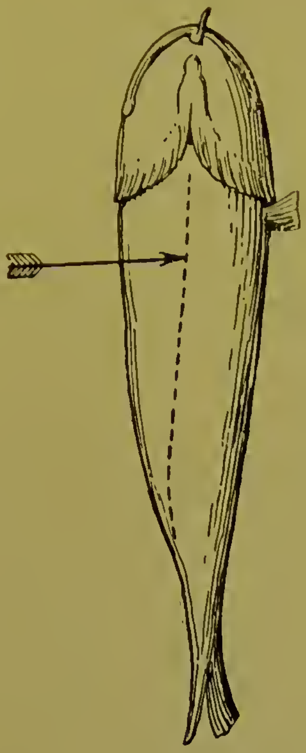
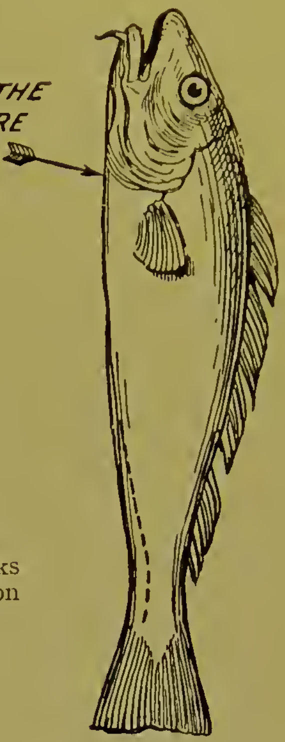


Fig. 1.

Method of Cutting Cod

The dotted line marks the line of incision, not straight to the tail.



Cutting the Cod

The dotted line marks the cut, continued on the side of the fish.

Fig. 2.

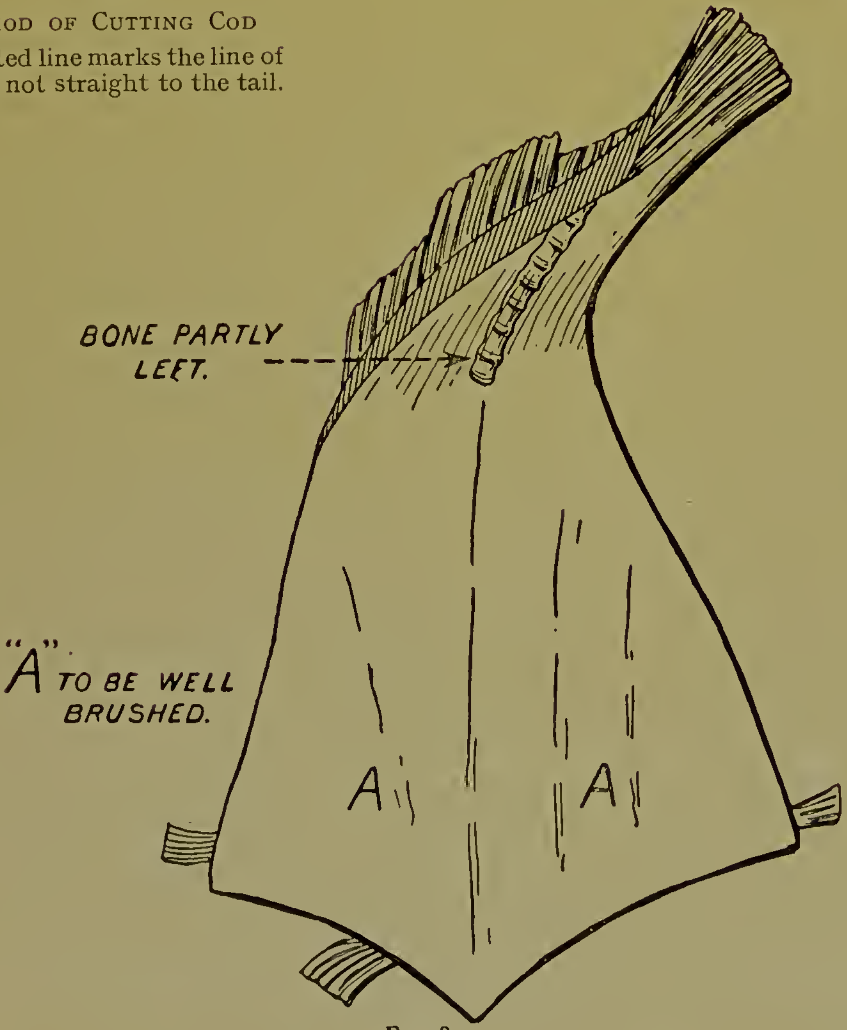


Fig. 3.

Method of Cutting Cod

The bone is partly taken out and partly left and the fish well brushed (A).

engaged in the business would pay more attention to complying with the local rules and regulations of the Antwerp market, a matter of great importance if a right sale is to be effected. The manner in which the fish are cut up is shown in the outline drawings which are here appended, and concerning which we may add a few words of explanation. It will be observed in Fig. 1, where the line of the incision is marked by a dotted line, that the cut does not run straight from head to tail but turns to one side at the tail end, and, as is shown in the next illustration (Fig. 2), is continued on the side of the fish's body, thus giving two portions, one smaller and one larger and thicker than the other. After the fish is cut and the bone partly taken out and partly left, as is represented in Fig. 3, the cod should then be thoroughly washed at once.

Too much backbone must not be left in, otherwise the bleeding will be imperfect, and in order to assist in this process of emptying the fish of blood, the tail is twisted from right to left in a corkscrew motion, being at the same time bent up and down. It is then thoroughly brushed and washed, the importance of this being that the flesh does not come out white unless it is done. The cod is then put into salt, which covers it and makes its own pickle, being left in this for five days, after which it is repacked in fresh barrels, which in a few days are closed down.

In the above manipulations those upon which stress should be laid are, first of all, the thorough cleansing and emptying of the fish from blood; secondly, the process of repacking is extremely important, because if this be done before the fish are thoroughly salted the flesh will exhibit yellow spots here and there, where the imperfectly cured fish have been lying in contact with each other. To avoid this, some fresh salt should be placed between the fish. Thirdly, the barrels themselves should not be made of soft wood, which is apt to give the flavour to the contents, but of a hard kind.

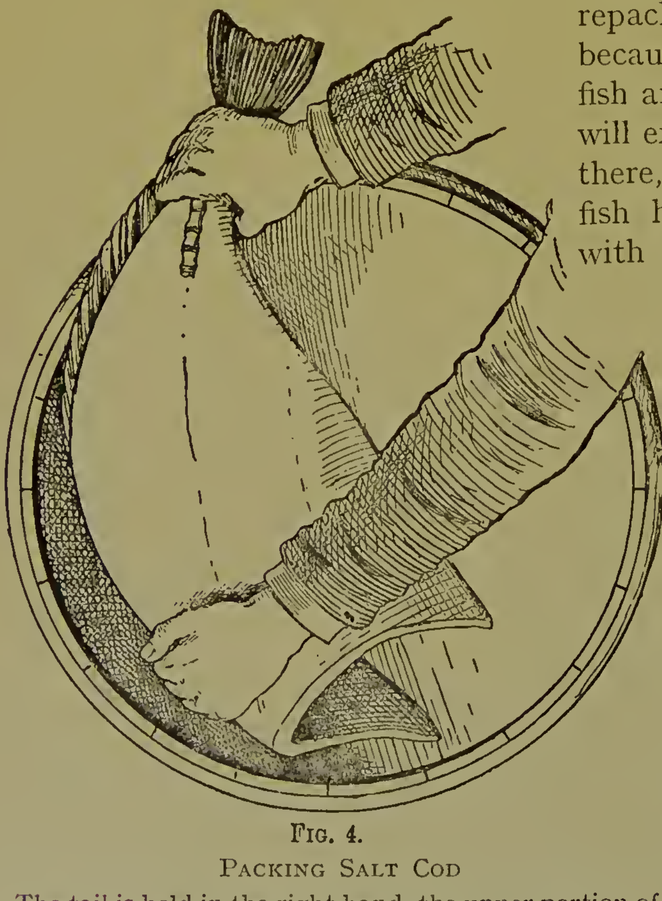


Fig. 4.

Packing Salt Cod

The tail is held in the right hand, the upper portion of the fish in the left and the fish folded as shown.

Packing the Fish. The method of doing this is shown in Fig. 4, in which it will be observed the tail of the cod is held in the right hand and the upper part of the body in the left, the fish being folded in the manner shown in the illustration. One side of the

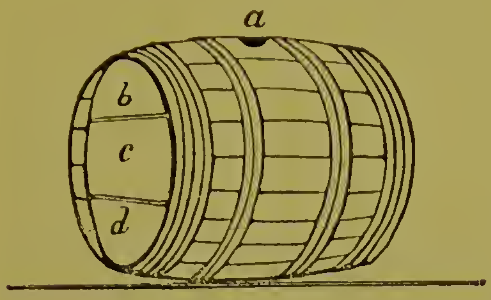


FIG. 5.
COOPERING
(*a*), Bung-hole on side of barrel; (*b*), (*c*), (*d*), Staves forming the head of barrel.

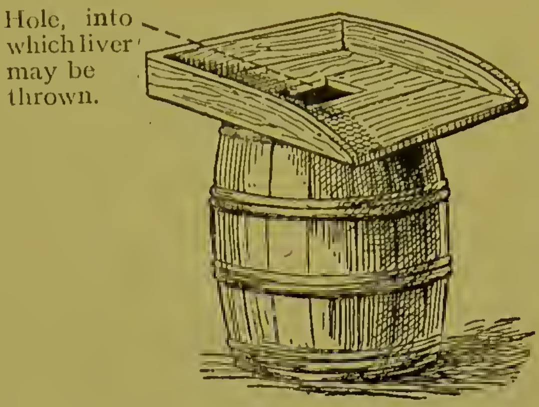

Hole, into which liver may be thrown.

FIG. 6.
A SIMPLE AND USEFUL CONTRIVANCE
By which a barrel may be used as a work-table for cutting up the fish, &c.

fish is darker in colour than the other, and the white side should be laid uppermost until the top layer is reached, when the dark side is placed upwards. Each layer in the barrel should consist of two fish.

The above, which is the Dutch method of dealing with cod-fish, is far superior to that used in some of our own curing-places, and especially is it so on account of its attention to details. Thus it is no uncommon occurrence for British fishermen to kill the fish by a blow or a kick on the head, which is said to result in giving the fish a deeper colour. In the Dutch method the fish are either bled immediately at the position indicated in Fig. 2 or the fish are frequently brought alive to the market by keeping them in a well. Another point of importance is the quality of the salt selected, it being a mistake to cure with salt that is too sharp in its taste, no uncommon mistake in British curing. Those cod-fish which are smaller in diameter than the barrel in which they are packed are known as small fish, and bring a smaller price per barrel than others (Fig. 7).

Curing of Mackerel. The mackerel is a fish which requires to be very carefully handled if it is to retain its good condition, and for this reason it is one of the fish that the inspector will pay particular attention to in order to ascertain its fitness for food. On account of its readiness to become soft and flabby, the fishermen of Norway prefer to catch their mackerel on a line, and there is not the slightest doubt that the best cured mackerel are those which are taken in this way from small boats close inshore, whence they are landed immediately and taken at once to the curing-shed. When they are caught in nets, the fish should not be thrown into a vessel along with the nets, but should be carefully taken out as the net is hauled in and placed in a separate part. They should be taken to the curing-shed in boxes, and on their arrival should be split, cleaned, and salted without any loss of time.

Transport of Mackerel. It happens, of course, that the curing-shed in many cases is some distance from the point of landing, and it is under

A Fine Catch of Skate at the Aberdeen Fish Market
With the steam-trawlers alongside, the view also showing some rows of either cod or large haddock in the background.

Cod at the Aberdeen Fish Market

Cod, Halibut, &c., at the Aberdeen Fish Market

A Great Catch of Cod and Hake at Aberdeen Market

The Wet-fish Department of an Aberdeen Factory

Fish Depot, Aberdeen

these circumstances that unsound fish are apt to find their way into the market. If they are simply carted in bulk from the one place to the other in hot weather there is bound to be deterioration, and this is a fish which should not be exposed at all to sun or wind. Any kind of cover is better than none, because exposure to the weather rapidly causes the skin to harden and, as a result, to tear in the curing process. In a word, mackerel should reach the curing-shed in the shortest possible time after being caught, and with the least possible rough handling.

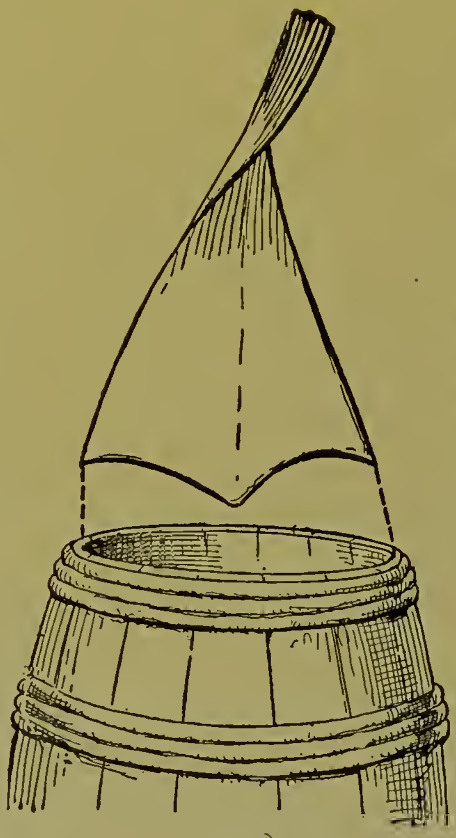


Fig. 7.

Packing "Small Fish"

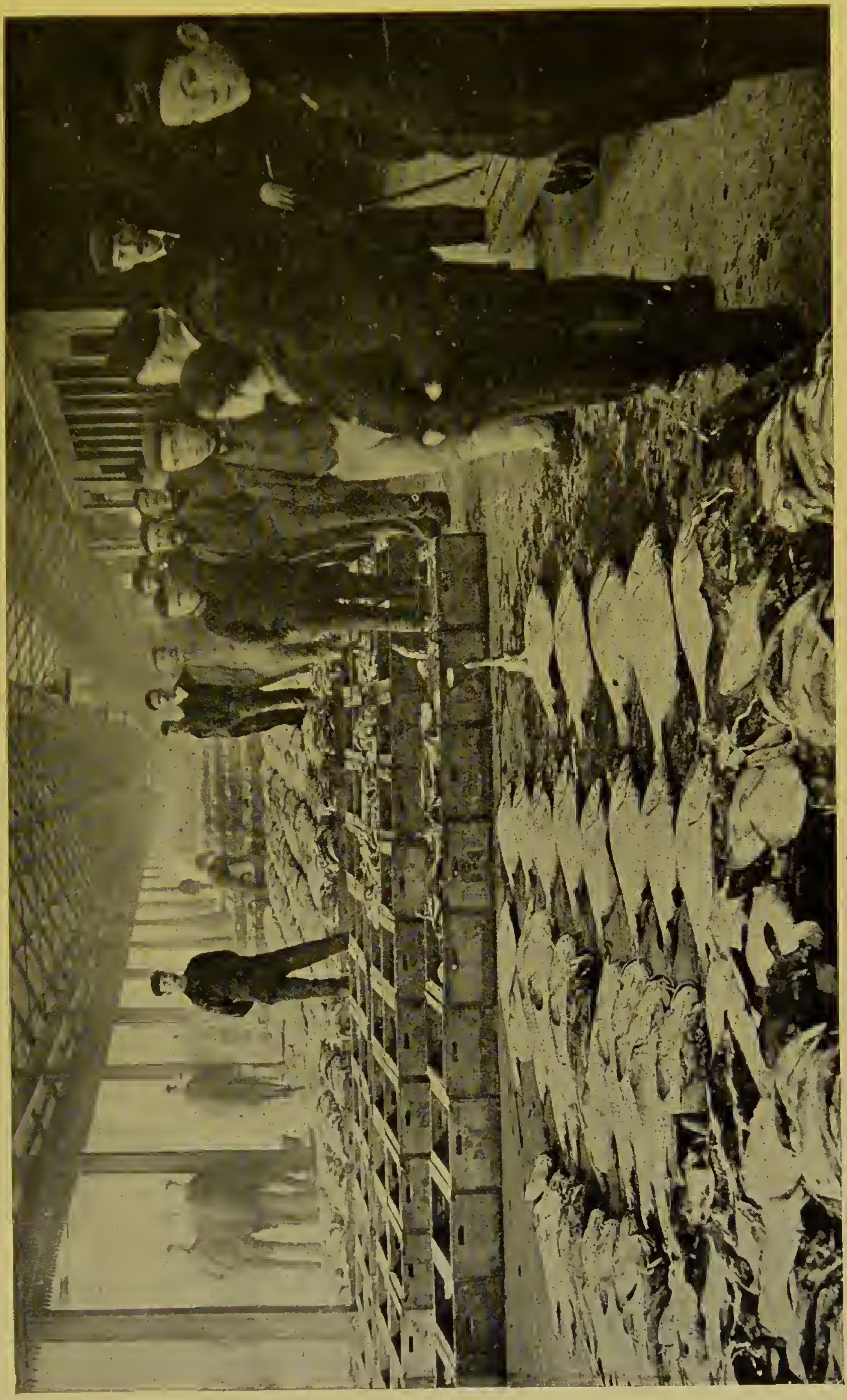
i.e., Cod less in diameter than the barrel.

Cutting the Mackerel. The fish should be cut with a clean, very sharp knife which leaves no jagged edges, and the incision should run down the back from head to tail, a clean cut the whole distance. The knife is carried as close as possible to the skin so that the lower part of the belly is separated, and the fish must not be flattened until it is cut. The cutter then separates the intestines and passes on the fish to the gutter, who in turn takes out any remaining gut and gills, running his finger along the backbone to express remaining blood. In order to rid the fish of the blood behind the backbone a puncture is made by the knife at the end of the bone, through which puncture this blood can be forced out.

Washing the Fish. Either salt water or fresh water is used for washing, but it must be clean and the operation performed in a broad tub or special vessel, a barrel being unsuitable for this purpose. The washing is done in three stages. There is, first of all, a quick swilling to remove remaining blood; then a second washing in which the fish are left in the water for a little while; thirdly, a transference into clean water, where they may remain for about an hour.

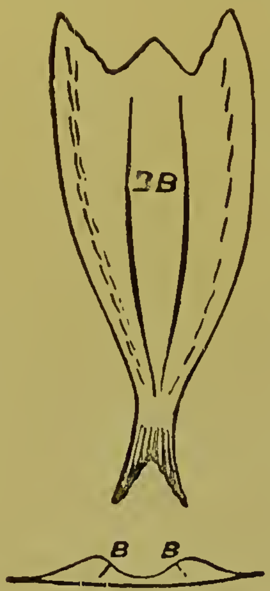
Reaming Mackerel. This is a final process to which the mackerel is subjected before salting, and consists of making a shallow incision from the bottom of the belly to the head; but on no account must the incision pass through the skin. The line of the cut is that indicated by the letters *BB* in the diagram on page 306 (Fig. 8). This process must be performed before salting is done at all.

Salting Mackerel. Whenever the weather is at all warm the salting process must be done as soon as possible, and, in fact, should not be delayed under any circumstances, keeping in mind the readiness with which this fish deteriorates. Mackerel should be placed back downwards and



Cod and Halibut at the Aberdeen Fish Market sprinkled with just enough salt to cover every part, and then transferred into the barrel, the first few being laid skin downwards to prevent the flesh coming in contact with the wood, and remainder skin upwards. They are arranged so that the tails are in the centre and the heads point towards the staves of the barrel, with a layer of salt between each, just sufficient to prevent any actual contact between fish and fish. The barrel is then headed up, laid down on the bilge, and pickle added through the bung-hole until the barrel is quite full, in which state it is left five or six days. The pickle itself is made either of very clean salt water or from clean fresh water to which salt is added, and the barrel must be kept full.

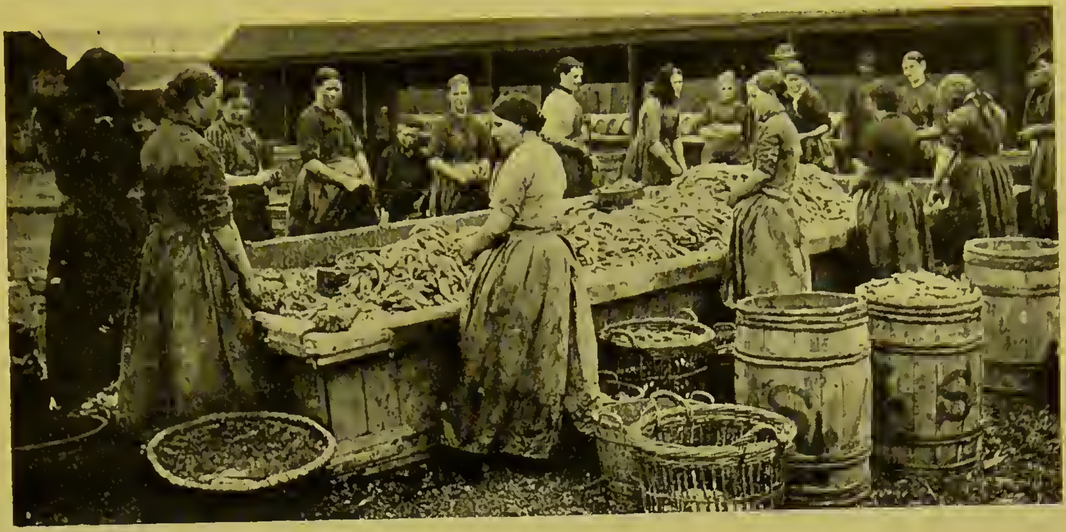
Packing the Mackerel. From the first barrel above described the mackerel are repacked into the shipping barrel, which is done in a manner similar to that in the first case, except that a few layers at the top of the barrel are packed flesh upwards, in order that the quality of the fish can be seen and inspected. A little salt is placed between each layer and about an inch of salt at the bottom of the barrel. The fish are sorted into different sizes, so that any given barrel contains fish of the same size.



Reaming Mackerel

Fig. 8. *BB*, Shallow cut below the bone.
Fig. 9. Cross-section. *BB*, Position of reaming.

The Smoked Fish Department, Aberdeen



Scottish Women gutting Herrings at Aberdeen

These women go with the fishing fleet as far as the coast of Cornwall, gutting each night's catch as it comes ashore in the morning.

Gutting Herrings

Packing Herrings in Barrels

HERRING-PACKING

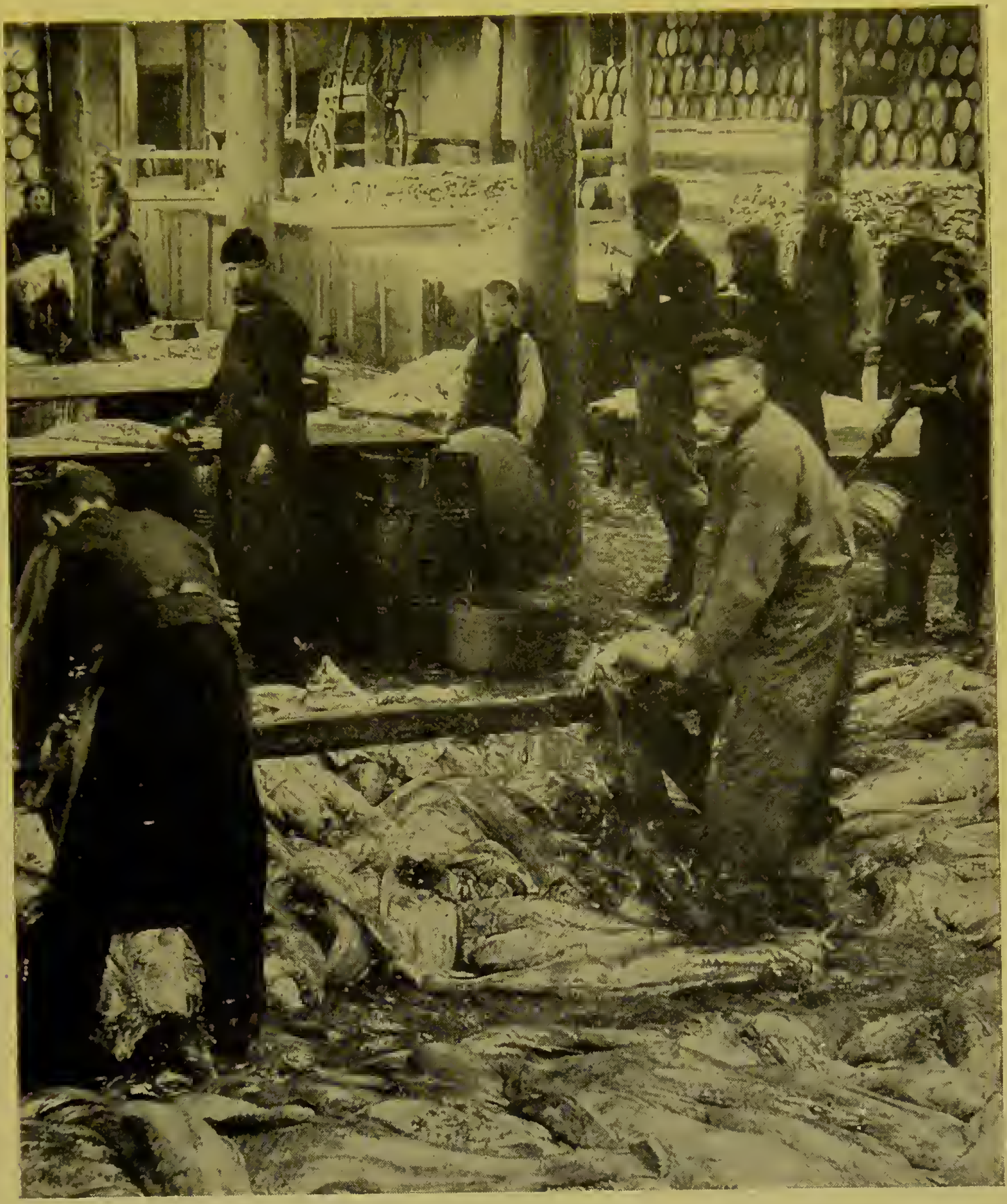
"The barrels should be good and made of well-seasoned hardwood (birch), capable of holding, for European markets, 220 lb., and for American markets 240 lb., of herrings. They should be hooped with six good 1½-in.-wide iron hoops, and be soaked in clear sea-water for twelve hours at least before the herrings are packed in them. The herrings should be brought to the curing-place as soon as possible after being taken from the nets, but in no larger quantities than can be easily dressed and packed in one day, and should be emptied into large bins, about 18 in. high, so arranged as to allow the water to drain off the herrings ; and these should be sprinkled with fine salt as they are put into the bin, in order to preserve their scales."

How the Dressing is done. "The work of dressing should begin

Eleven Monster Cod, Averaging 77 Pounds each

Sold at the Aberdeen Market, March 1908. The fish on the man's back illustrates a familiar, short, thick-set type of cod, contrasting with the longer specimen hanging in the foreground.

(*From a photograph, the property of Messrs. Smith, Aberdeen.*)



Cleaning and splitting Cod and Ling (Park and Co.'s Yard)

immediately after the herrings are landed, and they should be packed in their respective barrels as they are gutted and sorted, the dressing to be performed in the following manner: Hold the herring in the left hand, stomach up, and in such position that the head reaches beyond the thumb and forefinger. Insert a small straight-edged and sharp-pointed knife, with the blade held in a vertical position in the right hand, just below the gill-lid, on that side of the herring nearest to the right hand, and force it through the throat so that the point of the knife may come fully an inch outside the opposite gill-lid. Then press the forefinger against the head and the thumb across the pectoral fins, grasping the throat between the index and middle fingers, and with a smart jerk haul out the intestines (stomach, crown-gut, liver, and heart) along with the gills and pectoral fins, and leave only the milt or roe in the herring. Care must be taken to insert the knife so deep that the large vein that lies close to the neck-bone be divided, and to get the blade of the knife on the inside of the œsophagus or gullet, in order to get all the intestines out in the one cut. Care should also be taken to make a clean cut, and not to expose the ribs nor make the cut larger than necessary. Each gutter should be furnished with a small tub for the offal and one or more baskets for putting the dressed herrings in; he should also sort the herrings in their different qualities and sizes as he dresses them and hand them over to the packers, who should pack each size and quality into their respective barrels."

Drying Cod and Ling (Park and Co.'s Yard)

The Salting Process. "It is recommended to 'rouse' the herring (that is, to roll them in fine salt) before packing them in the barrels. The herrings should be packed well on their backs in layers, the one layer across the other the whole barrel through, and each layer supplied with two head herrings and a sufficient quantity of salt, according to the size, nature of the herrings, and the conditions under which they are packed, which must be learned by experience. The herrings should be given no more salt than will dissolve in the pickle and at the same time cure herrings safely, but care must be taken to give them enough so that they will not spoil. If salt is found in the barrels when the herrings

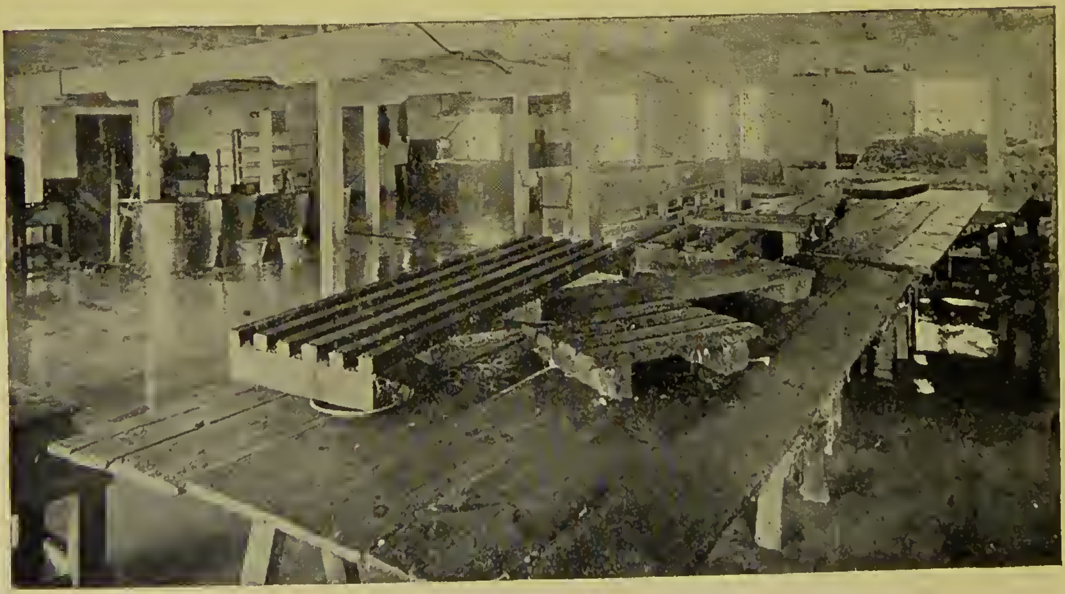
The Cured Article: The Filling-up Process (Bruce and Co.'s Yard)

reach the markets, they are held to be over-salted and their value is lessened; and it sometimes happens that they are difficult to sell at any price. On the other hand, if they have too little salt they will spoil and be condemned. Middle-sized herrings of a fairly good quality will take about one barrel of salt to five barrels of herrings, when properly cured for the markets, exclusive of the pickle; but it must be understood that this cannot be taken as a fixed rule, as various circumstances under which the cure takes place, and the size and quality of the herrings,

Barrels of Cured Herrings for Export

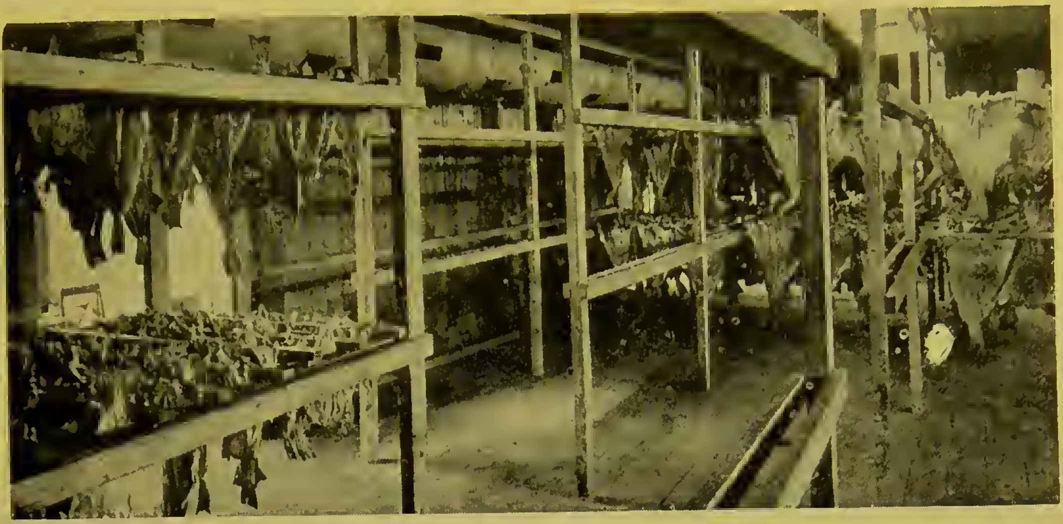
HADDOCKS READY FOR CURING

FISH-CURING, SHOWING SPLIT FISH ON THE STICK

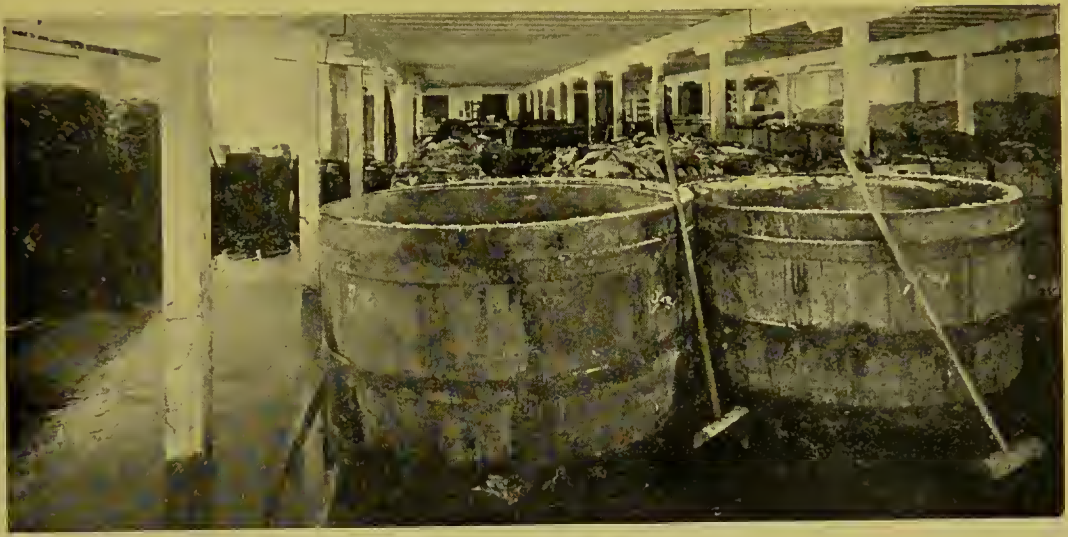


THE ROOM IN WHICH THE FISH ARE SPLIT AND CLEANED
On the tables may be seen the footboards on which the employees stand.

Messrs. Mellis and Son, Ltd., Aberdeen.

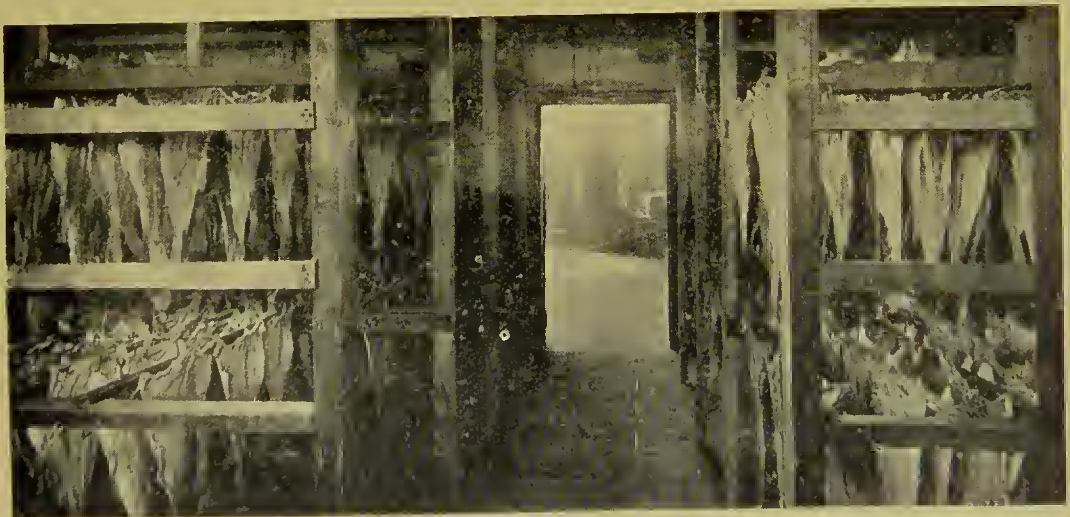


ROOM FOR DRYING HADDOCKS, SHOWING THE ROOF AIR-PIPE



DRYING COD

A cargo of loose fish, just arrived, is seen behind the large pickling-tubs while the space on the left is occupied by dried fish.



CROSS-PASSAGE, SHOWING DRYING-PIPE OVER DOORWAY may make it necessary to increase or decrease this quantity of salt mentioned."

Finishing for the Market. "The barrels should be filled with herrings to one layer above the chime and covered up with canvas and tarpaulins until the next day, when they should be filled with herrings of the same day's pack, headed up and pickled with sufficient strong pickle made of pure clean sea-water. Should the weather be frosty, it is advisable to head up the barrels and pickle them before night, or soon after they are packed if the frost is severe. The herrings should remain in this condition until they are struck through, which will take from twelve to eighteen days, according to the condition of the weather ; but during that time they must be looked after and supplied with pickle, if necessary. It is also well to give the barrels a little turn every second day during that time.

"When the herrings are struck through properly, they should be taken away and made ready for market. This is done by unheading the barrels, drawing off the original pickle through the bung-hole, and filling up the barrels with herrings of the same date's pack and quality. The barrel should be filled so that the coopers require to press down the head in order to get it in its place. Should the herrings be for export, the original pickle must be filled in the barrels again, and after it has been strained, and the barrels headed up and made perfectly tight ; but if the herrings are intended for American markets, clean pickle must be filled in the barrels, instead of the original blood-pickle, after the barrels are filled properly with the herrings of the same pack and quality. All barrels should be properly blown with a blow-pipe before they are shipped, and the date of packing and number of herrings each barrel contains be marked on the side of the head of each barrel" (Douglas).*

FISH RESIDUES

The fishing industry, as one of the sources of the food-supply of the United Kingdom, is carried on more or less all round the coasts. It has become centralised, however, to some extent in such towns as Grimsby and Yarmouth, which are the most important fishing centres on the North Sea and where the beam-trawl fishery for bottom fish is carried on to a greater extent than at any other place throughout the country. There are, however, other great herring markets in the United Kingdom, such as those at Fraserburgh, Wick, Peterhead, and Aberdeen, and at each of these ports during the herring season there is much activity. On the west coast of England the fishing ports are not so numerous, but one at least, namely, that of Fleetwood, has developed quickly during recent years. A considerable centre for the fishing industry has also been established at Milford Haven, and there are minor stations, such as Dingwall and Baltimore in the south of Ireland, and Downingbay in County Donegal in the north. At none of these stations, however, does the harvest from the sea compare with the great fishing centres at Grimsby and Yarmouth.

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* "Douglas's Encyclopædia."

The herring-fishing season extends from the month of October on to the month of March, and while many of the herrings are sold in the fresh state, there are also thousands of barrels which are salted for export to Germany, the United States, and other foreign countries. There is also a large quantity appropriated for the manufacture of kippers, which are simply split herrings with the viscera removed, and which are smoked in smoke-stoves by means of smouldering hardwood sawdust. The salt-curing of fish is carried on on very extensive lines, and, as a consequence, much employment is given at such places as Aberdeen.

The Fishing Supplies. The herring is said to be "the king" of fish, owing to the vast numbers in which they are caught, and second in importance as an edible salt-water fish is the cod, which is also handled in the same fishing ports as have already been mentioned.

White fish, such as whitings, bulk very largely at some seasons of the year, and while cod and whiting are also sold in the fresh condition, they are cured either by dry-salting or in pickle and subsequently dried. Mackerel, which are so extensively caught off the shores of Ireland, are similarly treated and eviscerated and then packed in salt, being mostly exported to the United States.

On the coast of Cornwall and the south-west coast of England there is a distinct kind of fishing in connection with the harvest of pilchards, these being fish somewhat like the herring in shape but not so rounded in form.

These various fish form by far the largest part of the fishing supplies in the United Kingdom, and, in the process of handling them, they give rise to a large quantity of residual matter, which has hitherto only received small attention.

Fish residues may be classified in the following way :

(1) Herring waste derived from herrings which are being prepared for curing in pickle or dry salt and which consists of the head and gills and the viscera, or may consist of the gills and viscera alone.

(2) Kipper waste derived from herrings which are split and from which the gills and viscera are removed. These fish are destined to be smoked and sold as kippers.

(3) Cod-fish waste consisting of the head, gills, viscera, and backbones of cod-fish and including the liver, which is always separated at the time of cleaning the fish.

(4) White-fish residues consisting of the residue from whitings or haddocks from which the head, gills and viscera are removed.

Fish Residues as Manure. From each of these different processes the residues are very large, and hitherto it has been only partially utilised for industrial purposes. At many ports there are no means whatever for converting these residues into marketable products, so that, as a consequence, they have simply to be barged out to sea and thus wasted.

As far back as 1862, M. Rohart commenced the drying of refuse heads and backbones of cod-fish, which are very abundant on the Norwegian coast and round the Lofoden Islands. His process was a very primitive one, however, and consisted simply of laying the residues on heated floors and evaporating the excess of water, until the resulting material became hard and dry, after which it was ground into a powder and utilised as fish-guano.

Since then much attention has been directed to fish residues as a source of nitrogenous and phosphatic manures, owing to the curtailment of supplies of natural guano from the Peruvian coasts, and, as a consequence, a few factories have been established at various points of the United Kingdom, so as to utilise the ever-growing residues and convert them into marketable manures. Such factories are in existence at Wick, Fraserburgh, Montrose, Falkirk, Fleetwood, Milford Haven, Hull, Grimsby, and one or two other places, but these factories do not utilise a tithe of the produce which is available, and there is every likelihood of more attention being given to this branch of industry in the future, so that the utilisation of fish-waste products may be more specialised than has hitherto been the case.

Of late years quite a demand has arisen for fish-guano, from Japan and the East, notwithstanding the fact that the Japanese fisheries are said to be the largest in the world and that fish-guano is also being made there in large quantities.

There are two kinds of fish-guano made, namely, that which is derived from herring waste and the other from white fish, and they have totally different characters.

The herring and kippering waste are difficult to handle, owing to the fact that they contain large and varying percentages of fish-oil. At certain seasons of the year, the fish-oil present in herrings may reach as high as 20 per cent. and again fall to less than half of that amount. During the herring season, however, when the shoals of herring are available, the fish-oil present is at its maximum, and the residues then are highly charged with this material, which has to be extracted before the remainder becomes available for the manufacture of guano.

Methods of Extracting Fish-oil. There are several ways of extracting fish-oil. One of these is by boiling the material in an excess of water and agitating it in a large mechanical agitator, so as to set as much of the oil free as possible. The oil under such conditions naturally rises to the surface and can be skimmed off. That method, however, is extremely crude and does not result in a good, fixable guano, and, besides, involves extra evaporation of liquid and also large storage-room for the whole of the material.

Another method is to heat the residues while they are being agitated, in a steam-jacketed pan. These pans are made of a circular pattern and have a capacity of about two tons at one time. The residues are simply thrown into the pans and, when full, a cover is placed in position, and agitating arms fixed to a horizontal shaft are set in motion, while the steam is turned on so as to produce a high temperature. When the material has been cooked, it is then allowed to fall out of the pan into sacks, which are placed on large iron plates and which form part of a hydraulic press. When the plates have been built up until the press is full, the hydraulic ram is set in motion and the liquid, composed of oil and water and fine organic matter, is expressed from the material and is collected in large tanks, where it is allowed to settle. The oil rises to the top and can be skimmed off, the remaining liquid and organic matter being discharged and thrown away. This method has considerable objections ; the smell which is given off during the process is most offensive, and there seems no way by which it can be reduced. If, therefore, such operations are carried on, they must be conducted in a factory remote from any town, otherwise the odours are likely to become a public nuisance.

Another way of extracting the oil is to take the raw material, and more especially is this the case with kipper waste, and place it immediately in bags in measured quantities and place these at once in hydraulic presses. The presses are set in motion, and very slowly the oil is pressed out, and in this way a fairly oil-free substance may be obtained.

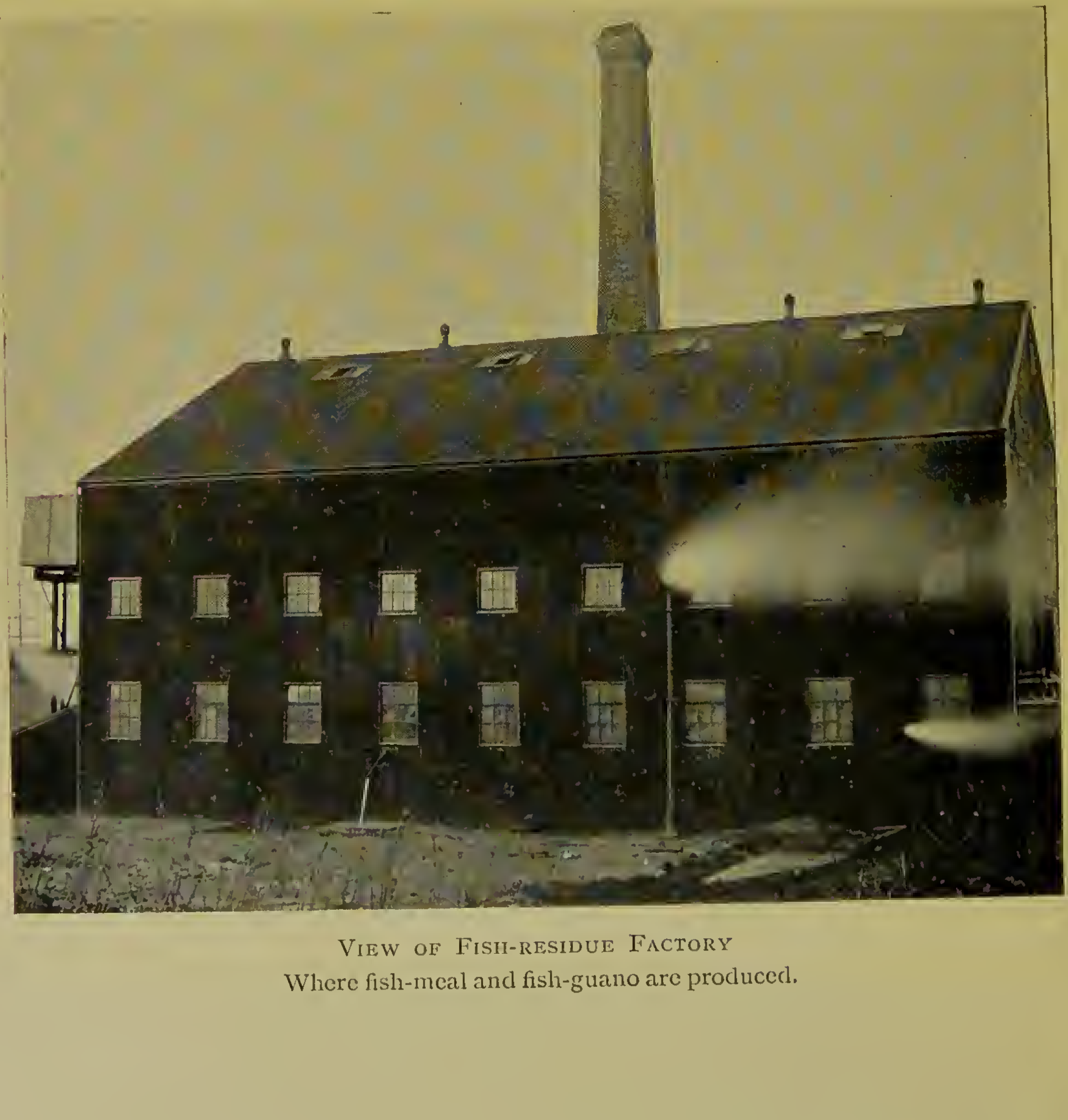
By none of the processes, however, is the oil entirely eliminated, and this interferes with the subsequent drying of the residues, so that a different class of guano from herring waste than from what is derived from white fish is obtained.

White-fish residues, such as those from cod and whiting, are very abundant in Aberdeen, and are utilised there, and also at Montrose, so as to produce guanos of a lighter appearance than what is obtained from herring waste.

The process in the handling of these wastes is practically identical, and a description of the interior of a modern fish-residue factory would represent what is recognised as the best practice everywhere.

Interior Arrangements of a Fish-residue Factory. A building designed for a fish-residue factory is best constructed on three floors, and on the top floor there should be a platform upon which the residues may be landed by means of a hoist from the bottom. The residues are immediately put into a fish-residue cutter, which is a powerful machine and so designed that as the material is fed to it, it is carried forward by means of a screw to cutting-knives, which divide up the material into fine portions, discharging it through apertures in a plate. The material is then allowed to fall into a cooking apparatus, where, by means of steam-jets, live steam is applied for about twenty minutes. The material is then dropped into a hydro-extractor or centrifugal separator, travelling at about 750 revolutions per minute and by means of which some 60 per cent. of the water present is at once liberated. The semi-dried material is then allowed to fall into waggons and, immediately thereafter, is dropped into circular horizontal fish-driers, measuring 12 ft. long by 6½ ft. in diameter and of about two tons capacity. In the centre of these driers there is a rotary spindle, to which heavy arms are attached at intervals, and by means of gearing outside of the drier, this spindle with the arms is made to rotate at a very slow speed, not more than twenty revolutions per minute. The drier itself is quite fixed, but it has a steam-jacket right round about it, and in this way heat is applied to the contents of the cylinder while agitation proceeds. The effect of this stirring up of the residues, assisted by the steam-heat, is to liberate the moisture present quickly, but the process of the evaporation is also accelerated by the placing of a fan, driven at a high speed, on the top of each drier, and which causes such an exhaustion of the contents of the cylinder that a partial vacuum is the result, hence the evaporation is very quick. Before the contents of the drier become powdery, such as is required in the fish-guano trade, the process will have occupied from eight to ten hours.

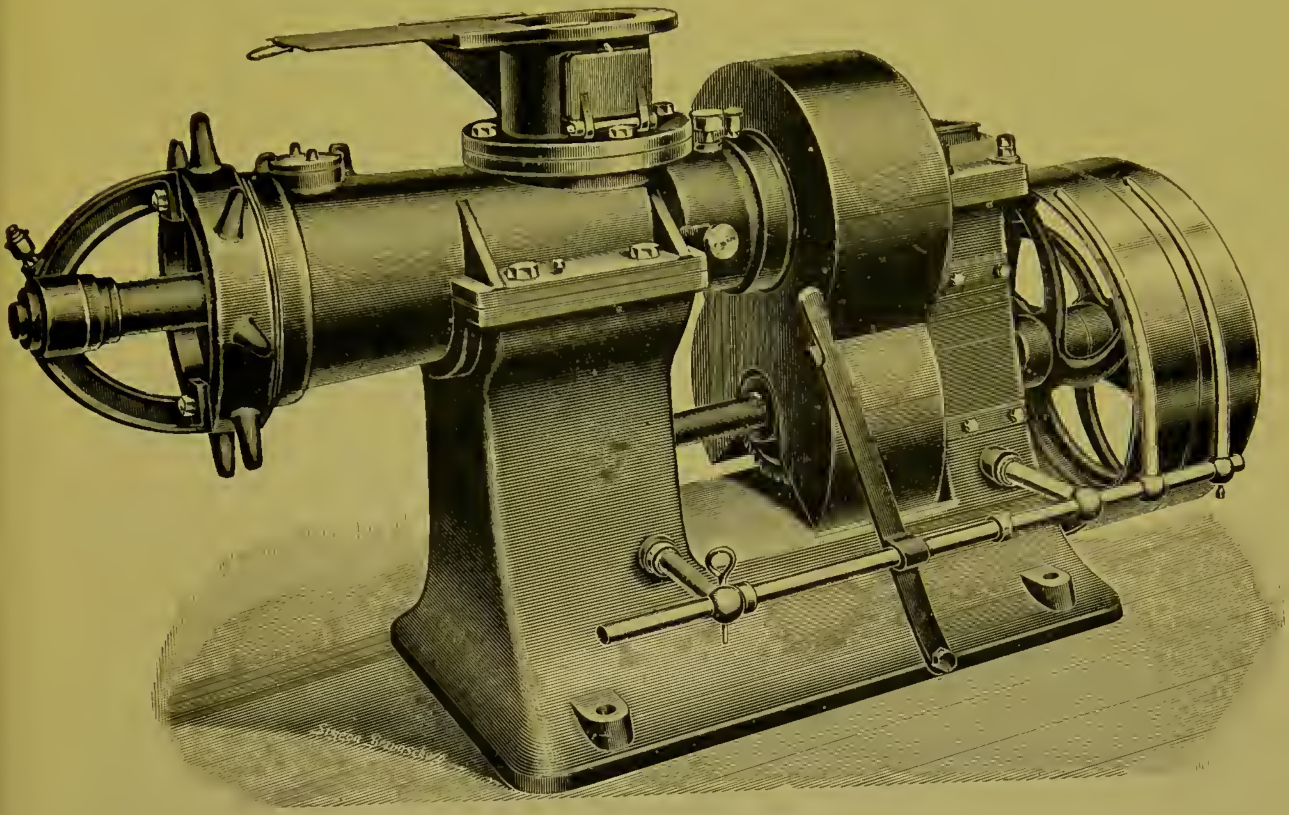
The odour which is given off by fish-residue drying is very offensive, and the only way by which its offensiveness can be lessened is by directing an exhaust from the fan already mentioned into a condenser, where the condensible gases come in contact with a copious stream of water and are thus absorbed. This water containing the gases can be run away and got rid of, but the non-condensible gases which remain have to be dealt with, and arrangements have to be made so that they can be carried from the condenser into the flue of the boiler fire, and in that way are burnt and any offensiveness is thus destroyed.



View of Fish-residue Factory
Where fish-meal and fish-guano are produced.

How the Factory is equipped. It will be understood that the foregoing process refers more to residues that are free from oil than to oleaginous residues, it being considered desirable very often to simply dry the latter without the previous cooking process.

The product from oily residues is a dark fish-guano, soft to the touch, whereas the product from white-fish residues is a light-coloured guano which is dry and friable and commands a higher price than the darker commodity.

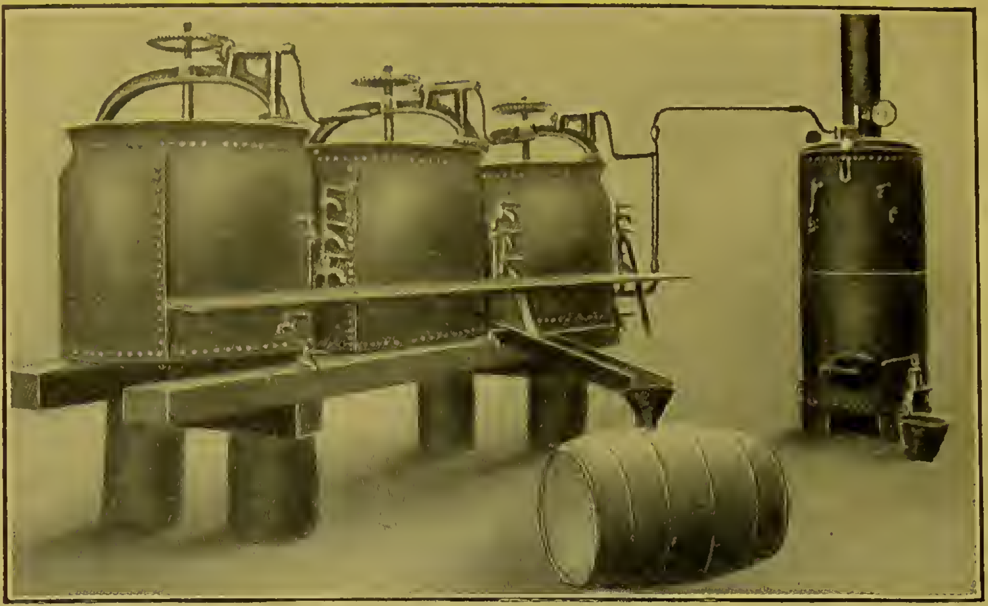


Fish-residue Cutter

The total mechanical equipment for such a factory consists of:

(1) Steam-boiler,
(2) Steam-engine,
(3) Fish-residue cutter,
(4) Hydro extractor,
(5) Fish-guano drier,
(6) Vapour-condensers,

and as the plant is a simple one, there is no reason why factories should not be more common. The residual fish waste from fish markets and shops in towns and cities is, for the most part, thrown away, and, by means of the process which has been described, could be converted at very small expense into a useful manure. Fish-guano is usually sold on analysis, and the values of the two main constituents, namely, phosphate of lime



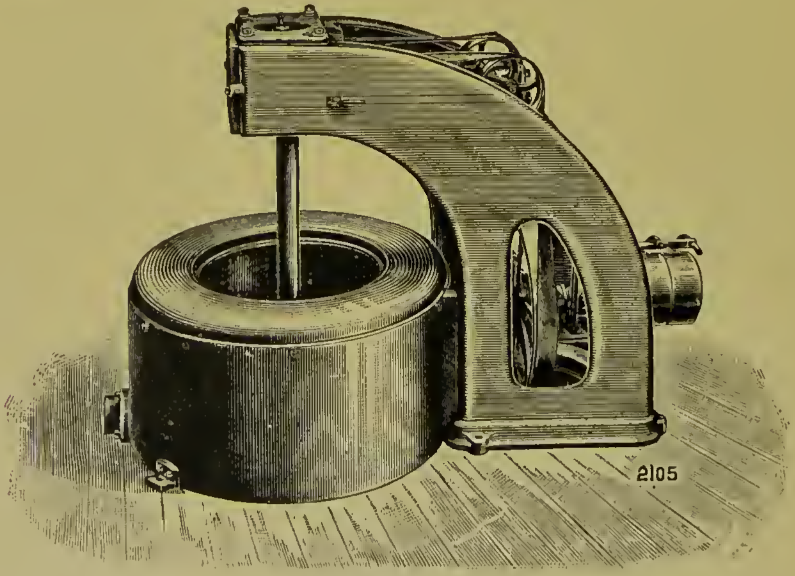
Complete Cod-liver-oil Plant

Showing the rendering-pans with taps at different heights so as to enable the oil to be run off at intervals as it is boiled out of the livers.

and nitrogen, are what are taken as the basis of the value of the manure. An analysis of an average sample gave the following result :

Phosphate of lime . . .	17.28 per cent.
Nitrogen equal to ammonia . .	10.50 ,,
Water	18.98 ,,

The value of the unit of ammonia was taken at 10*s.* per unit and the value of the unit of phosphate of lime at ninepence, hence the guano was worth £6 per ton. When it is considered that the cost of fish residues varies in fishing ports from 10*s.* to 15*s.* per ton, it will be seen that there is a very considerable margin of profit.



Hydro Extractor

For removing the excess of water in fish residues.

The Production of Fish-powder. A development of the fish-residue drying business which is attracting considerable attention is the manufacture of white-fish residues into fish-powder, sometimes described as "fish meal." This is done in practically the same way as adopted in producing the guano, but the material is first of all carefully selected, and cod-heads are cleansed and washed and the backbones are retained. The internal viscera are entirely eliminated, and by means of the cutter, cooker, and drier, a fine powder is produced which is capable of being used for edible purposes and which is highly nutritious.

White-fish residues are also used in their entirety for the making of a fish-meal, which is in considerable demand for cattle-feeding purposes and is utilised in the manufacture of cattle-feeds in the shape of fish-cakes and similar products.

The principal product from the cod is cod-liver-oil, which is derived from the liver. In white fish the oil is centred in the liver, whereas in fish of the herring species the oil is to be found in the flesh. Hence, when cod are caught, the livers are separated out at once, so as to preserve their freshness, and they are treated sometimes in a small way, simply by cooking until the oil is eliminated and floats on the top. In larger factories the livers are broken up and are allowed to ferment for a day, after which the material is then run into closed cooking-pans and is cooked until the oil is set free. When the heat is withdrawn, the oil rises to the surface and the great bulk of it can be decanted off. The remainder, however, has to be filtered through filter-presses, so as to separate the residue or "foots" from the clear oil. In order to meet market requirements, there are two grades of oil usually prepared for industrial purposes, one of these being first quality of oil and the other being a second quality, derived from the "foots." From the first quality there is another which is prepared by means of the elimination of the stearine present in all cod-liver-oils.

The stearine present in cod-liver-oil forms an objection from the point of view of a medicinal oil, hence it has to be separated out by means of extreme cold, and for this purpose an ingenious machine has been devised in combination with the refrigerating machine, so that as the oil flows over this machine it is reduced to a very low temperature and the stearine is separated out. The whole bulk is then passed through a filter-press and the stearine is left behind, the clear medicinal oil passing on. Cod-liver-oil prepared in this way is quite clear at 28° Fahr., and in that non-congealable condition is the usual market product sold for medicinal purposes.

INSPECTION AND HANDLING OF FISH

Inspection of Fish. For the adequate performance of this work a considerable amount of special experience is required, and this can only be obtained by spending a certain amount of time in connection with the public health departments of one or other of the large centres of the fish industry. Thus the Chief Sanitary Inspector of the Fish Market in

Glasgow informs us that this market has the services constantly of one of the special officers attached to the sanitary department, who has a special knowledge of fish both from experience and study. The present inspector was brought up in the market from boyhood, and during all his younger days there, paid all attention to the study of fish and their diseases. He goes to the market by seven o'clock each morning, when the fish arrive in boxes from the railway station and the steamers. As the boxes are delivered in the market between seven and nine o'clock, he inspects them in lots, taking a good percentage in each case in order to ascertain their condition with respect to freshness and fitness for food.

It is impossible to fix a set standard for passing or condemning fish. A good deal must be left to the knowledge and experience of the inspector, whose official action in connection with the soft or flabby fish must always be considerably controlled by the state of the weather, as this class of fish will not bear any handling or keep for any length of time in warm weather.

Determination of Quality of Fish. The following remarks on this subject are from the pen of Dr. W. E. Hope, M.D., Medical Officer of Health for Liverpool, whose writings in connection with meat and food inspection we have referred to in various parts of this work :

" The chief points to be noted in determining the wholesomeness of edible fresh fish are :

" (*a*) Freshness.

" (*b*) The season in which they are on the market, as this is associated with their condition as to spawning.

" (*c*) The places from which they are taken, as the nature of their food is involved.

" (*a*) **Freshness.** With regard to the freshness, fish should be firm to the touch. The duration of the stiffness of recently caught fish depends upon the weather, and passes off in from six to twelve hours ; the eyes and skin should be bright and glistening ; the gills bright red, unless dulled by ice ; no trace of offensive smell. Fish keep best if killed and gutted immediately they are caught ; if dealt with in this way they remain fresh from two to three days longer ; they deteriorate most quickly when caught by the gills in nets and allowed to die slowly in the water. Trawling-boats going very long distances to the fisheries are provided with chilling apparatus or ice, by means of which the fish can be brought in good condition from distant fishing-grounds.

" (*b*) **Influence of Season.** In regard to the influence of season, most varieties of fish are decidedly out of condition during spawning, some also during the time preceding and following it ; they become thin and lose their flavour. The time of spawning varies considerably. In the case of salmon, rivers are closed under statutory regulations from five to six months, usually from September to February, with a view as much to ' preserve ' the fish as to ensure wholesomeness ; this close season varies in different districts, and smuggled salmon may be perfectly wholesome The following table indicates the spawning periods of the principal edible fishes ; the black lines indicate the limits of the spawning period, the crosses (x) indicate the maximum of spawning; the dotted lines include the months when the fish is 'out of season.' This is to some extent a matter of individual opinion, and there are many degrees of being out of *condition*. All of the periods are liable to some amount of local or annual variation, but the table may be taken as a fair average."

	Jan	Feb	Mar	Apr	May	June	July	Aug	Sep	Oct	Nov	Dec
Salmon	…… —								…… —	…… — ×	…… —	…… —
Plaice	…… —	…… —	…… — ×	—	—							
Dab	……	—	—	—	× —	…… — ×	…… —	……	……	……	……	……
Lemon Sole				—	— ×	—	—	—	—			
Sole		…… ……	…… ……	—	—	—						
Cod	—	— ×	× —	—	—	—						
Haddock	—	—	…… —	…… —	…… — ×	……						
Whiting			…… —	…… —	…… —	— ×	—	—	—			
Gurnard			…… —	…… —	…… —	…… — ×	—	—	—			
Turbot			……	…… —	— ×	—	—	—				
Brill	……	……	—	—	—	—	—					
Flounder	…… —	…… —	—	— ×	—	—						

"**Locality.** The locality is chiefly of importance in the case of stationary shell-fish, such as oysters, mussels, &c., taken from sewage-contaminated waters, the noxious matter being sometimes taken in by the fish with its food, or the body of the fish being merely soiled with the filth" (*see* article on Food, "Encyclopædia Medica").

Dr. Bulstrode's Report. An inquiry into the conditions of growth of oysters and other shell-fish was made a few years ago by Dr. Bulstrode, the results being published in the 24th Annual Report to the Local Government Board. Amongst other points in this Report are the following. Although oysters are generally supposed to be the most common source of infection in cases of typhoid and choleraic conditions which originate with shell-fish, there is no doubt that all the evidence points to other shell-fish as being just as liable to be the means of dissemination. Many of the beds in which "natives" are grown, or where foreign oysters are deposited for purposes of fattening them, can hardly escape being contaminated with the discharge from sewers, which, of course, means that they are liable to have the germs of typhoid fever coming from patients in contact with them.

Professors Herdman and Boyce. Investigations bearing upon the same problem were carried out by these two observers, who came to the conclusion that sea-water was inimical to the growth of typhoid bacilli. This they established by washing infected oysters in a stream of sea-water, finding that the organisms did not multiply. They also found other organisms of the colon group in other shell-fish on sale in towns, but not in those taken from pure sea-water. Anærobic sporing bacilli like the *Bacillus enteritidis sporogenes* were demonstrated in various shell-fish, all of which led them to conclude that "it is evident from these experiments and a consideration of all the facts brought to light in recent years in regard to the bacteriology of shell-fish and its influence on public health, that we must regard oysters, mussels, cockles, &c., as nutritious food-matters, which, from their nature and circumstances of their cultivation and sale, are liable to become contaminated with organisms, pathogenic or otherwise, and their deleterious products."

They also conclude that the peculiar green colour of some oysters imported from America and laid down to fatten is due to copper, but the same colour in the Marennes oyster is not so caused.

Disease of Salmon. Those who have had intimate dealings with this fish are aware that there exists a disease of salmon which destroys a large number of fish, and the question of the cause of this condition is of considerable importance from the point of view of public health, because fish exhibiting this condition are not uncommonly found in fish markets exposed for sale as food. A considerable number of investigations on salmon disease have been made, the earlier results of which seem to point to the condition being caused by the fungus *Saprolegnia ferax.* These investigations, however, were mostly carried out before the science of bacteriology had reached its present condition, and more recently it has been investigated by Dr. Patterson, of Glasgow, who carried out an exhaustive investigation into the etiology of salmon disease. Various points in the method of behaviour of the fungus mentioned suggested to Dr. Patterson that there might be some primary bacterial infection which produced the dead tissue on which the fungus grew so readily. Dr. Patterson specially observed that this fungus grew rapidly on the *dead fish,* and having made cultures for purposes of inoculation, he was satisfied that this was not the original cause. As the result of an exhaustive investigation, full details of which were published by the Fishery Board for Scotland in 1903, Dr. Patterson came to the following conclusions, which are taken from the Report in question :

(1) The fungus *Saprolegnia ferax* is *not* the cause of the salmon disease.

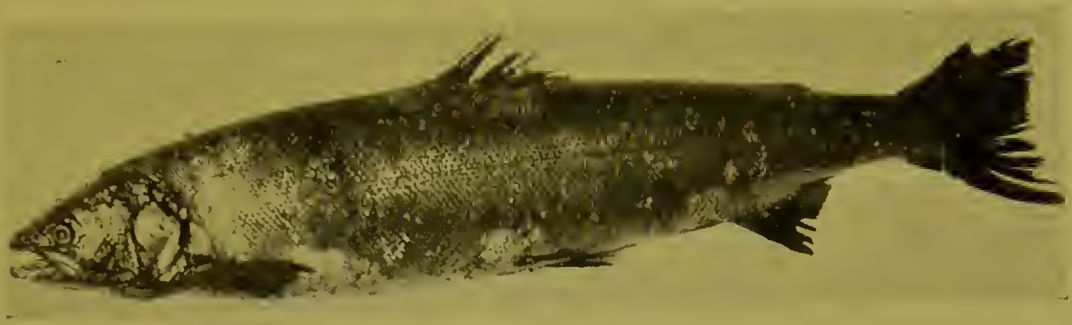
(2) The disease is due to the invasion of the tissues of the fish by a special bacillus (*Bacillus salmonis pestis*).

(3) The bacillus gains access through abrasion or ulceration of the skin, and the disease is apparently not contracted when the skin of the fish is in a healthy state.

(4) *Bacillus salmonis pestis* can be transmitted from dead fish to living fish in the same water, and since dead fish are a suitable nidus for the growth of the bacillus, it is obviously desirable to have all dead fish removed from the river and burned immediately they are observed, as by simply burying the fish the germ is left in a condition to be again carried into the stream.

(5) The fact that the bacillus grows profusely when placed in a freezing mixture of ice and salt, while a temperature of 37° Cent. soon destroys it, shows that the cold season is more favourable to its growth.

(6) Fish akin to salmon are more susceptible to the disease than others, as rainbow-trout and sea-trout when attacked succumbed in from two to four days, while dace and goldfish died in about eighteen and thirty-five days respectively.

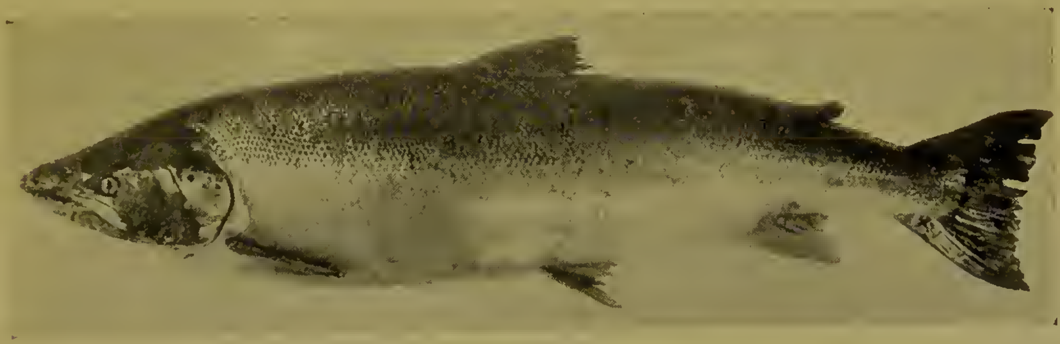


Salmon Disease (Dr. J. Hume Patterson)

(7) *Bacillus salmonis pestis* grows well in sea-water, whereas *Saprolegnia* does not grow at all ; therefore a diseased salmon entering the sea, and returning to the river apparently free from fungus, cannot be said to be free from the disease.

We are indebted to Dr. Patterson for illustrations of fish showing the disease.

Contamination of Shell-fish. Several kinds of shell-fish used as food are eaten uncooked, and as a result are very likely to be carriers of infection and disease should they happen to have become contaminated with pathogenic germs. Such contamination may occur at any part of the process of gathering the shell-fish, storing them, or transporting them to the market. Most cases probably arise at the original place of collection. The Liverpool Health Authorities examined a series of samples in 1908 with a view to ascertaining what germs, if any, were present in these, with the following results :



Salmon Disease (Dr. J. Hume Patterson)

Most samples were found to be contaminated.

The *Bacillus enteritidis sporogenes* was found on twenty-eight occasions.

The *Bacillus coli communis* was found on thirty-two occasions.

The total number of shell-fish submitted for examination was: Mussels, twenty-five; oysters, thirty-one; periwinkles, fourteen; cockles, sixteen; total, eighty-six.

Fried-fish Shops. Fresh fish as seen in the markets and fishmongers' shops are not the only parts of the fish industry to which the attention of the inspector must be directed. No less important, though probably somewhat neglected, is the inspection of those establishments which are extremely common in the large centres of population and which are known as fried-fish shops. We are not here concerned with the duties of the inspector of nuisances, but it may be just mentioned in passing that this official may be often required by the inhabitants of the district to prevent annoyance. The point, however, which concerns us is the quality of the fish itself which is used in these places for preparing the food, since it is probable, in many cases, that it is not the best fish which is used up in this way. The inspector should see the fish in these establishments *before* it is prepared for cooking as well as some of that which is ready to be sold; and he will time his visits at such periods as he is most likely to discover fish which is unfit for food. For that reason it is especially important that his inspection should frequently take place on a Monday, and particularly on a Monday night. The majority of trawlers and other fishing-boats are in harbour on Sunday, and very little fresh fish is landed in the markets or in the shops on a Monday morning, most of that which is on sale at that time being what is left over from Saturday. This, of course, applies to a great deal of other fish besides that found in the fried-fish shops. But it is here especially that the fish which would not be offered for sale in the ordinary high-class fishmonger's shop finds a way of disposal, and a careful inspection of these places will reveal the fact that a good deal of it is in such a condition as cannot be described as fit for human consumption. However, it is not only the fish itself, but the fat and other material in which the fish is cooked, that is apt to be rancid or otherwise objectionable. The ventilation and other hygienic conditions in these establishments should have careful attention given to them by the proper authorities.

Poisoning from Decomposing Fish. From clinical and pathological observations on this subject the conclusion appears to be warranted that the toxins produced in decomposing fish and crustaceans are distinctly more powerful in their action than those which are produced in the decomposition of the ordinary flesh-producing animals. Bocklisch is of opinion that it is in the *first* stage of decomposition that the worst effects of fish are produced, a point which should not be lost sight of by the inspector of fish markets. The symptoms produced appear to be very similar, if not identical, with those found in cases of poisoning from bad sausages.

The special signs which indicate the onset of decomposition in fish are thus summarised by Girlach : " Bad fish are to be considered as unfit for food when the eyes have lost their sheen or the cornea is somewhat cloudy, the red gills pale, and the meat soft so as to pit on pressure with the finger, or, finally, when the scales are easily loosened." Should the decomposition have proceeded to a late stage, there may be very obvious signs of the formation of putrefactive and fermentative gases. A test which is readily applied is recommended by Baranski, the procedure being simply the laying of the suspected fish in water, *when those which are fresh and in good condition immediately sink, whilst any putrefying fish float upon the surface.*

REFRIGERATION IN THE FISH INDUSTRY

We have dealt fully with the whole subject of refrigeration and cold storage in general in another part of this work (Vol. II.), and only wish here to draw attention to a special application of it, namely, in connection with the fishing industry. The subject has recently received notice at the hands of Mr. Crawford Heron (in the issue of *Cold Storage* for December 16, 1909), and we quote the following paragraphs from the article in question :

" It would be difficult to find amongst the many articles of produce placed daily upon the market one characterised by greater irregularities with regard to supply and demand, and, consequently, huge differences in prices, than that which we all agree is one of the finest articles of diet we have, *i.e.*, fish. We have periodically sudden rises, and correspondingly sudden decreases in prices, so harmful in every direction, these rapid and special changes in value being solely due to the irregularity and uncertainty of a steady supply.

" If the huge quantities of fish landed around our coast during the summer months could be cold stored sufficiently until the winter months, a much steadier supply could be maintained, and at the same time the prevention of that appalling waste of one of our most valuable foodstuffs would be effected. I have known during the month of August on Billingsgate Market alone a quantity of over three hundred tons of fish condemned, and a proportionate quantity is destroyed at all our large centres of population, resulting in disastrous losses to both catcher and merchant."

Preserving the Fish. " Up to the present time the refrigerator as a means of preservation has been but little used in the United Kingdom in connection with fishing ; and, as far as fitting the machines on the vessels is concerned, in the few cases in which refrigerating machines have been installed on board the trawlers they have not turned out satisfactory.

" Regarding the keeping of the fish after catching, and pending discharge at the port, the general method is for the trawler to take on board, before sailing, a quantity of ice, varying from five to fifty tons, according to the size of the trawler, where fishing, and the time of the year. The fish-room is insulated and divided into compartments, and also fitted with removable shelves. After the fish is caught and cleaned a layer of ice is put on a shelf, upon which is placed a layer of fish, to a depth of about four layers of each, then another shelf is placed in position so as to take the weight. By this method fish is kept in fairly good condition for upwards of fifteen to twenty days, naturally a great deal depending on the time of the year and place of working.

" It is interesting to note that to provide the necessary ice for dealing with the fish there are on the coast, at fishing ports alone, thirty-eight ice factories connected with the fishing industry, capable of producing an aggregate annual output of 401,800 tons."

Refrigeration on Board Trawlers. " Up to the present time in the British Isles the refrigeration on board the trawlers has not made much headway, due to the extra cost in fitting and working, and also to the fact that the fish when iced and put away in a careful manner can be landed quite fresh, but, of course, it will be seen that when working in the tropics or hot climates, unless the vessel can make extremely short voyages, a refrigerator fitted on board must be a distinct advantage.

" The first appliance fitted on board a trawler, as far as I am aware, was on board the Aberdeen steam-trawler *St. Clements*, twenty-six years ago, but owing to the expense attached to the working of this apparatus, it was only used for a few voyages and afterwards discarded. In the year 1886 several other trawlers were fitted with machines, and a single insulated fish-room was cooled by air from a compressed-air refrigerating machine. This method was supplanted later by ammonia plants, with direct-expansion pipes suitably arranged in the fish-rooms. By this method the room was kept at a low temperature and the fish frozen hard, but it was found that the freezing had a bad effect on the quality of the fish, the reason for which I hope to deal with later. The latest and most successful plant fitted is one which has the dual capacity of manufacturing ice and keeping the fish-room cooled by means of an air-cooler and steam-driven fan. The fish is iced in the manner I have already described, using a less quantity of ice, and the room is kept cool by the circulation of cooled air of 38° to 40° Fahr., which retards the melting of the ice, but does not stop it altogether. The melting of the ice prevents the drying effect of the cold air, and keeps the fish wet and clean."

An Expert's Opinion. " In connection with the fitting of machines on board trawlers, I have much pleasure in quoting the opinion of Mr. W. H. Dodds, principal of the Dodds Steam Fishing Co., Ltd., of Aberdeen, whom I look upon as the real pioneers in this particular branch. Mr. Dodds says : ' My experience in connection with refrigeration on board trawlers is that working the home waters they are not necessary—in fact, I believe better without them—but for working the Portuguese or Morocco coasts they are a decided improvement on the ordinary method of keeping fish. I consider that our men have only now succeeded in getting into the proper method of working them, *i.e.*, when we first fitted them on board the vessels their idea was almost continually to keep the machines going, and the result was that they froze the fish and made them like bars, but they have now become acquainted with the correct method, so that they can now keep their chambers at about 30° to 32° Fahr. by simply working the machine eight out of every twenty-four hours, or, say, after the chamber is down to the required temperature you may let your machine remain for four hours, then work two hours, and so on.'

"The first practical device for the freezing and preserving of fish was patented as far back as 1861 by one Enoch Piper, of Camden, United States of America."

Experiments by a London Syndicate. "In England, however, the cold storage for fish has been but little used. I believe the only plants put down in this country solely for the cold storage of fish were in Grimsby by Mr. H. Smethurst, and in Hull by Mr. Spring. Neither of these was, I think, a success, but these experiments were made many years ago, and since then refrigeration has made great strides. Some time ago, I believe, extensive experiments were carried out on behalf of a London syndicate, freezing fish packed in ice in boxes. The experiments were made with various kinds of white fish, but were entirely unsuccessful. Thus we find that up to the present time the experiments carried out in the United Kingdom for freezing fish have turned out failures. The freezing has a most unsatisfactory effect on the flesh. From outward appearance fish that has been subjected to a temperature of from 12° to 14° Fahr. for a considerable period appears to have preserved excellently, perhaps with the exception of the eyes, but once the fish is cut up or cooked the fact that it is not freshly caught is at once apparent, the flesh presenting a very woolly appearance and being absolutely devoid of all flavour. Dr. Anderson, the Medical Officer of Health for Rochdale, in his Scientific Report of 1907 to the Fisheries Board for Scotland, on the decomposition of fish, is most instructive, and gives us the reason for the pulpy appearance of frozen fish and the absence of flavour. He dwells on the structure and chemical composition of the muscular tissue of fish being such as to facilitate the easy invasion of bacteria and the early onset of decomposition. With regard to structure, we find that in mammals the red variety of striped muscle predominates, whereas in fishes it is the pale variety that is general.

"In pale muscles the striations are less regular and the fibres much more readily break into small filaments, and these again into discs. The fibres are not so much bound into separate and strong bundles as in the red muscle of mammals, and when we compare the edible portions of the pale muscles of fishes and the red muscle of mammals we find that the former has usually less fat and much more water, and that the tissues are less vascular and have a looser texture ; thus the susceptibility of fish-muscle to the attacks of putrefactive micro-organisms is greater than that shown by mammalian muscle. It is this strength of muscle which undoubtedly very largely accounts for the success of the refrigeration of beef and mutton. Again, the percentage of water found in fish is greater than that found in beef or mutton.

"Comparing medium beef and mutton with haddock and sole, we have the following comparison :

	Beef.	Mutton.	Haddock.	Sole.
Water	72	74.75	81.75	86.75
Proteids	21	18	17	12
Fats	6	6	.25	.25
Inorganic salts	1	1.25	1	1 "

Experiments with Hake. "Some time ago experiments with a large quantity of hake were made, and the following procedure adopted : A large quantity of fish was hung in a room at a temperature of 20° Fahr. until it was thoroughly frozen through, and afterwards placed in a large heap in a room of a cold stores at a temperature of 18° Fahr. This was done in the summer, and during a scarcity in the winter the fish was disposed of at considerable profit. To outward appearance the fish was unaffected by the freezing, but every customer complained. They did not dispute the question of freshness, but said there was something the matter with the fish, and they did not know what it was. Undoubtedly during the freezing process there was great disintegration of the tissues, which, of course, affected the firmness of the flesh, and I am firmly of the opinion that if fish is required to be kept for a considerable period it must not be frozen, as the tissues cannot stand the freezing as in the case of beef and mutton. When in Lisbon during the summer of 1907 I had an opportunity of seeing many voyages of fish landed from boats fitted with refrigerating machines, and owned by Messrs. Dodds, of Aberdeen, and, to my surprise, I found that the fish landed from these trawlers made less money than the fish landed from trawlers that had kept their fish in the ordinary manner with artificial ice, the reason given being that the fish landed from the trawlers fitted with refrigerators deteriorated much more rapidly, and also did not possess any flavour, &c. At that time it was the practice on board the vessels to dispense with the use of ice altogether and freeze the fish in the fish-rooms, and, as I have already stated, this method has now been discontinued, and I believe much better results have been obtained.

"It may be asked, 'Why has salmon been fairly successfully treated ?' This, I contend, is owing to the fact that salmon lends itself to freezing owing to the muscular tissues being much firmer and, more important still, containing a smaller percentage of water and a greater percentage of fat than any other fish, perhaps with the exception of the eel."

The Question of Temperature. "If from the foregoing we agree that fish of the ordinary white varieties must not be frozen, the question arises, 'What is the best temperature in which to keep fish if desired to be stored for an indefinite period ?' Dr. Anderson states that in his experiments he found that from 0° Cent. to 3° Cent. (32° Fahr. to 26.6° Fahr.) will inhibit the action of most bacteria of putrefaction, and at the same time keep the fish in a condition of rigor.

"This appears to me to be the nearest solution I have arrived at during my investigations, and the results of numerous experiments I have made have gone far to confirm the same. The ranges of temperature I have given are fairly wide, and, as far as I have been able to gather, we have not any data nor have experiments been made to determine the actual temperature at which the liquid portion of the average white fish freezes, and this is the temperature we must not go under if we desire successfully to deal with the fish and preserve the tissues.

"In America at the fish-freezers at the Great Lakes they estimate that the loss in quality is due to the evaporation of the oils and moisture in the fish, which goes on even at the very lowest temperatures. Undoubtedly evaporation must adversely affect the quality of the fish, and how to prevent this evaporation in temperatures of from 28° to 34° Fahr. I cannot say, although I attach considerable value to Captain Söllings' special paper for preserving fish. Of course with all except prime fish it would be practically impossible to apply it when storing away the huge quantities of ordinary white fish during gluts when the storage would be chiefly in operation."

Does the Fish Trade want Cold Storage? "The question has been asked, 'Does the fish trade want cold storage?'

"I say unhesitatingly, Yes. Other traders find their salvation in cold storage, by the facilities with which they are able to keep good the products which remain on their hands unsold. The cold storage of fish must be done only on the coast immediately it is landed, and not at the inland towns, where the results attending the efforts of cold-storage companies in Birmingham, Manchester, Liverpool, and Glasgow, when catering for fish, have been very disappointing, not altogether owing to the fact that we have not arrived at the most suitable temperature for such rooms, but owing to the salesmen in most cases placing the fish in cold stores when it was already on the turning-point and expecting to receive it later in fresh condition, forgetting that deterioration would go on, and can at the most only be checked by cold storage.

"It may be a matter of surprise to you to find that in such an important industry as the fishing, which lands on our coasts annually fish to the value of at least £11,000,000, that so little has been done towards the better preservation of fish, and that there has been such an absence of scientific research so essential to modern progress.

"This is not altogether a matter of surprise when you consider the time and money required to make experiments on a large scale.

"The Fisheries Boards of our continental neighbours give every encouragement, financially and otherwise, on such an important question as affecting the general developments of their fisheries, which in importance falls far short of ours. Here, I venture to suggest, is an opportunity for our Department of Fisheries, who might make a substantial grant to pursue fully, in the interests of the general public as well as the fisherman, such researches, which would go far to arrest the immense waste of what I consider is our most nutritive article of food."

Concluding Remarks. We have now discussed the various kinds and species of animals which together make up the meat industry of this country, and for the sake of convenience we have in the case of the fish dealt at the same time with the question of their inspection. We have now to turn our attention to the Meat Industry proper, that is to say, that portion of it which is concerned in the handling of the great supplies of beef, mutton, pork, &c., which are either produced in this country or brought hither from abroad. This introduces us to an entirely different aspect of our subject, and is therefore conveniently dealt with in a separate volume.

END OF VOLUME I.

25 JUL. 1929

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